The Chemical Age

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Notes and Comments

The Oil from Coal Schemes

WHEN, a month ago, we commented on the Government's oil policy, we remarked that carbonisation would receive a valuable help from the assistance given in regard to the price of oils. This assistance would equally affect high temperature and low temperature carbonisation. We were not unmindful of the inherent dangers of assisting low temperature carbonisation and certain occurrences during the past month have served to emphasise these dangers. High temperature carbonisation is sufficiently well established to take assistance of this nature "in its stride," so to speak. Whilst high temperature carbonisation is a chemical operation, neither coke ovens nor gasworks are strictly regarded as belonging exclusively to the chemical industry. Hydrogenation, having been taken in hand by Imperial Chemical Industries, has become definitely a branch of chemical industry. In our view the greatest progress will be made in low temperature carbonisation if it is regarded as coming midway between high temperature carbonisation and hydrogenation, that is to say, if it is regarded as a task for the combined efforts of the carbonising experts and the chemical industry. The chemical industry, which in any event will deal with the oils produced, cannot be insensible to the welfare of low temperature carbonisation. It is most necessary that the mistakes of the past should be avoided and that financiers having no objects save the making of quick profits should not be allowed to hoodwink the public—as they have done in the past—with specious tales of the huge profits to be derived from oil from coal. The cause of low temperature carbonisation, which is largely that of smoke abatement, has suffered untold harm in the past from financial exploitation of the process. Had a small proportion of the money lost in speculation over the processes been expended in research, the industry would to-day have been flourishing and a source of real national wealth.

Danger of Ill-Advised Steps

THERE is, however, a second and more insidious danger in the Government's oil policy. The undertaking now being sponsored at Billingham is not the only one projected. The very natural desire on the part of the coal owners to find a profitable outlet for more of their coal is resulting already, as shown by paragraphs in THE CHEMICAL AGE for August 19, in a disposition to look into the possibilities as they exist in the several coalfields. In one way or another, there may arise great chemical industries founded on the chemical utilisation of coal. If half-hearted or ill-advised steps be taken in this direction and the enterprises fail, the production of oil from British coal will receive so great a set-back that investors will be rendered timid and further enterprises will not be possible for many years. It is, therefore, of the very greatest importance that nothing shall be done inadvisedly and that the best expert advice shall be secured. We deprecate talk of carbonising immediately 4,500,000 tons of Welsh coal. Let us walk before we run. Let us remember that Welsh coal is not generally in need of carbonisation; that most Welsh coal is already a natural smokeless product; that most Welsh coal will not yield oil in paying quantities. Interested parties are not the best suited to advise. Let them by all means put their schemes forward; that is just and logical. But as a matter of common sense let those schemes be examined by independent experts and carefully tried before being proceeded with on a mass production scale.

Gas Purification

DURING the whole of the life of the gas industry, only two processes have been in general use for the purification of the gas for sulphur. The earliest process was treatment with lime whereby the sulphur was entirely lost and the lime was discarded as valueless. When it became realised that carbon dioxide need not be removed from the gas the use of lime was gradually abandoned and iron oxide in the solid form is now virtually the only material used. The sulphur so recovered can be utilised in the chemical industry, either by direct burning of the spent oxide as a preliminary to the manufacture of sulphuric acid, or by extraction with solvents.

The article contained in THE CHEMICAL AGE, of August 19, upon purifier design, prompts us to wonder, however, if the day of the oxide purifier may not be passing. As we have frequently pointed out in these columns, modern industry, and particularly modern chemical industry, is a continual struggle between processes and between products, each competing for the same market. An established process finds a new one competing, which can operate at less cost; an established product is threatened in its own field by another one. Gas purification, so long firmly established upon standardised methods, now finds itself open to the same attack. There is under development a process using active carbon, from which the sulphur must be again extracted by solvents, but so far as we are aware no details of this process have been published. Several attempts have been made to extract ammonia as sulphate by using the sulphur contained in the gases to produce the necessary sulphuric acid radicle. The processes of Feld and Burkheiser and the Koppers C.A.S.

process are well known to chemists. These processes were all elaborate and failed for one reason or another; in view of the ammonia position it seems unlikely that any of these attempts will be renewed and experimenters will be well advised to regard this very difficult problem as not worth their while to proceed with unless some unusually simple method should appear.

A Sulphur Production Scheme

SEVERAL methods have arisen of recovering sulphur in the wet way. The American Koppers Co. originated a process based on the extraction of sulphuretted hydrogen by alkaline solution, the resulting sulphur being removed from the solution by a current of air and discharged into the atmosphere as H_2S. Such a process was both wasteful and difficult to apply in this country. The Ferrox process followed, in which the sulphur was extracted by an oxide of iron suspension. Again there was a difficulty; the sulphur was recovered in the elementary form, but so contaminated with iron as to be unsaleable at an economic price. Success seems now to have been achieved by a wet washing process which has been, we understand, officially accepted by the Ruhrgas A.G. for ultimate installation at all their carbonising works. In Germany it is dealing with some 50,000,000 cu. ft. of gas per day.

The implications are obvious. Germany is proposing to make herself independent of foreign sulphur and believes that she has found a way whereby in the fullness of time it can be done. The sulphur produced is claimed to be suitable for every purpose. If these claims are fulfilled there seems at least as much reason why the Government should support British sulphur production as British oil production. It would be a matter of congratulation if a by-product from gas and coke oven works could supply the whole of the sulphur needed by the British Chemical industry. It would be the more valuable since, as is well known, there is no sulphur deposit in the Empire that can compete with the American and Sicilian sources.

Practical Safety Methods

WHAT has the chemical industry accomplished during the past year in the control of accidents? What are the most important present-day accident hazards? What are individual companies doing to control these hazards? These are questions which executives from many chemical companies will discuss at the sessions of the chemical section of the United States National Safety Council, at the annual safety congress to be held at Chicago in October. A total of 266 different industrial units in the chemical industry, employing an average of about 74,000 men, reported their 1932 accident experience to the National Safety Council. These plants, as compared with a like group for the previous year, showed a reduction of 14 per cent. in frequency of disabling injuries, but they had the worst experience since 1926 in the severity of accidents. There was a drop for 1932 in permanent partial disabilities and temporary injuries, but a sharp advance in fatalities. Among 13 different groups for the chemical industry, manufacturers of carbon products had the lowest average accident frequency rate; coal tar distillation plants had the lowest average accident severity rate. The highest average accident frequency rate was among manufacturers of fertilisers, and the highest average severity rate was among explosives manufacturers. Other high accident frequency rates were among the coal tar distillers, in salt refining, and in vegetable oil extraction. Accident severity rates were especially high in dye manufacturing, chlorine and alkali manufacturing, and among the makers of industrial gases, pharmaceutical and fine chemicals, and vegetable oils. The purpose of this annual safety congress is the advancement of practical safety methods adaptable to the present day industrial revival. The speakers will be experts in their respective fields. They will deal with accident records, how to collect and tabulate them, and how to analyse and use them; the causes of hoisting chain failure, and the need for inspection of hoisting chains; the safe use of chemicals in industry, especially the safe handling of acids and caustics; the handling of materials by hand, industrial truck and tractors; the safe use of electricity, especially in portable electrical equipment; the use of low voltage in hazardous locations; ladder accidents and their prevention; the mechanical control of dust and fire prevention, from the viewpoint of safe storage, of flammable liquids, and the hazard of defective fuses and extension cords. These items are mentioned to serve as a reminder of the causes of accidents which can be prevented by the adoption of proper safety measures.

Consultants

CONSULTANTS, like others, have need to earn a livelihood. They sell service, whereas the manufacturer sells goods. Strange though it may seem, the chemical industry does not fully realise that this type of service commands a market value just as much as goods. The manufacturers may be in need of precise information which will place his plant on an efficient manufacturing basis; he may have difficulties to overcome, or new markets to find. The user of chemicals seeks information concerning the material which will meet his requirements most exactly; quality must be considered from the aspect of physical condition as well as chemical purity. The consultant is ready to supply this information, but he may not be consulted in a professional status when it is possible to obtain the desired information without the necessity to pay for it. In some cases he is regarded as a benevolent gentleman who is ever ready and willing to give his valuable experience in anticipation that " something better will come of it." If he is fortunate to be retained by some of the firms for whose industry he specially caters, all is well with him and the firms in question are the richer or poorer for their selection of a man to whom they may turn when confronted by problems. Even where the firm maintains its own research staff, the value of an outside consultant cannot be underestimated. He serves a useful purpose by giving an independent opinion, especially in cases where the ideas of the board differ from those of the research staff. For small services the consultant is justly entitled to a fee, even though it be a small fee. The solicitor demands his fee for the advice which he lays before you and the law upholds that demand as being fit and proper. The consultant, nevertheless, has food to buy and taxes to pay, in common with the solicitor.

Modern Petroleum Distilling Units

Heating and Corrosion Problems

DEVELOPMENTS in oil refining equipment during 1932 are reviewed by Dr. R. K. Fischer in the current issue of "Reports on the Progress of Naphthology."* The largest crude oil distilling units now running for the production of high-grade lubricating stocks, Dr. Fischer points out, are two 14,000 barrel per day two-stage units which have recently been constructed at a large refinery situated in the southern part of the United States. These units are of the now more or less generally accepted design, both the atmospheric and vacuum stages being complete with their own still, tower, heat exchangers and pumping equipment. In addition to the normal vacuum stage a flash jug representing a secondary vacuum stage has been installed for handling the heavy products. As a high-grade cylinder stock must be taken as a distillate, it is necessary to keep temperatures as low as possible, thus requiring the highest possible vacuum. In the flash zone of the primary vacuum stage the absolute pressure is higher than that at the top of the tower owing to the pressure drop through the fractionating plates in the tower. This increased pressure in the flash zone would result in high temperatures and/or a large steam consumption when taking high-grade cylinder stock as a distillate. To overcome this the cylinder stock is taken from the primary vacuum tower in the residue, which is then introduced into a secondary vacuum flash-chamber, the so-called vacuum flash jug, in which the absolute pressure is considerably lower than in the primary flash zone and practically the same as at the top of the main vacuum tower.

Heating by Diphenyl Vapours

Up to the present, heating in distilling units has been done more or less exclusively either by direct firing or by steam heating. It now seems as if indirect heating mediums other than steam are becoming more and more popular. This is due to the desire to use high transmission temperatures without the use of a heating medium at high pressure, and also to maintain closer control over the heat transmission process. The Indian Refining Co. have developed the Govers system using diphenyl vapours. The diphenyl is heated in a special furnace, and heat is transmitted to the oil by circulation of the diphenyl. It has been shown that there is practically no decomposition of the diphenyl, but the high temperatures involved in this process combined with the characteristics of the heating medium necessitate the use of special high resistant pipe material. Another feature of this process is that the risk of local over-heating of the oil is practically eliminated, thus permitting operation at a high mean temperature level. Mercury vapours have been used instead of diphenyl by the Sun Oil Co., the heating of the mercury being carried out in equipment similar to that used in the case of diphenyl. It is claimed that the results obtained are superior to those secured with the conventional heaters.

Throughout the oil industry the use of pulverised coke as fuel, either for direct heating systems or for the more recently developed indirect heating processes, is increasing. Although the knowledge of the high fuel value of petroleum coke is not new, it has not been extensively used in refineries owing to the lack of suitable burners. More recently very considerable development has taken place in the design of equipment for pulverising and feeding coke. Nevertheless, in many cases it has been considered more economical to run crude oils for the production of asphalt rather than to run down to coke.

Higher Overall Efficiencies

Higher overall efficiencies have been secured in refineries not only by increase of thermal efficiency, as described above, but also by increasing the percentage recovery of products from the crude oil as a result of the extensive use of gas recovery systems. General experience in distillation has shown that losses average about one per cent. of the charge between the crude oil distilling equipment and the storage of the finished products. It has also been recognised that these losses are caused principally by the evaporation of the light hydrocarbons, propane and isobutane. These two hydrocarbons, if retained in the finished gasoline, are largely responsible for its high vapour pressure. It was, therefore, a natural solution of the problem to eliminate propane and isobutane, which not only decreased the evaporation loss, but also permitted the butane content of the gasoline to be increased without raising its vapour pressure. Propane and isobutane are now being produced from gasoline recovery plants to an increasing extent in the form of "liquid gas." The hydrocarbons lighter than propane and butane are vented or rejected in the absorption and rectifying operation, and may be used if desired as fuel.

Eliminating the "Soaking" Period

The demand for products having high anti-knock properties has greatly influenced the development of cracking equipment. The effect of heating time and rate of heat input has been closely studied, and it is only quite recently that the importance of a steady temperature rise has been fully appreciated. This led to the development of special methods for the design of stills required for cracking plants, instead of using the design methods for ordinary distillation stills which had previously been used. The tendency in the design of cracking stills is to eliminate the "soaking" period of the oil in the still, particularly when handling heavy charging stocks.

An important feature of modern cracking is the re-formation of light naphthas to produce high anti-knock gasolines, and a further trend is a combination of reforming and cracking which is accomplished by cracking the bulk of the stock in liquid-phase followed by secondary cracking in vapour-phase of the light material produced. For this combined process pipe stills are used in which two or more separate streams are heated, and depending on the temperature range required the different operations are performed either in the convection or in the radiant heating zones of the pipe still. Where large capacities are involved separate pipe stills have occasionally been used. It can generally be assumed that for reforming more severe conditions of temperature and pressure are required than for liquid-phase cracking, and depending upon the process this difference amounts up to about 300 lb. per sq. in. pressure and 200° F. Up to the present time, however, these combined processes have not been proved to be definitely superior to those previously in use.

Colour of Cracked Spirit

Although the fractionation of pressure distillates has been continuously improved, the boiling range of these materials is still greater than that of straight run gasoline, and on account of this chemical treatment is more difficult and more involved if the evaporation and weathering losses are kept low. Nevertheless, the total distillate is usually refined as received from the cracking plant and redistilled later, although the latest practice is to debutanise the pressure distillate before treatment, thus reducing the capacity of both the treating and rerun plants. The latest practice for rerunning pressure distillate is to use a two-stage unit, the first stage operating at atmospheric pressure, open steam being used in the fractionating tower; the second stage operating under vacuum, with or without open steam in the fractionating ower depending upon the specifications imposed on the products.

In the early days of development of cracking equipment the colour of the cracked spirit was considered to be of considerable importance, and in order to secure a good colour distillate a large number of trays were installed in the fractionating towers of rerun units, and were responsible to some extent for the high cost of these plants. Gradually it has been shown that the elimination of corrosive sulphur and undesirable gum-forming constituents is of greater importance than colour, and this has resulted in the cheapening of the fractionating and treating equipment in which the pressure distillate is processed.

The importance of corrosion problems increases with the increase in temperatures employed in distillation equipment. Whereas for normal straight distillation operation a temperature of about 700° F. has represented the maximum to

* "Reports on the Progress of Naphthology, 1932." Reprinted from the "Journal of the Institution of Petroleum Technologists." Pp. 250. Price 10s. 6d.

which the oil has been heated, modern cracking processes require considerably higher oil temperatures, and in consequence higher tube wall temperatures. This necessitates the use of more resistant steel, particularly in those sections of tube stills exposed to direct heat radiation.

It is now more or less generally understood that surface films and potentials are the governing factors in corrosion resistance. The progress during the last few years in the study of films is of practical, as well as theoretical value, for investigations have shown that, depending upon the character of the film, corrosion can be either inhibited or accelerated. Furthermore, the continuity of the film on the exposed surface has been shown to be of considerable importance. It is now recognised that discontinuous films are the principal cause of pitting. The importance of this discovery lies in the fact that for the production of corrosion resisting equipment it is apparently of more importance to create a suitable surface—*i.e.*, a continuous resistant film than to find a material, the analysis of which would in itself render it resistant to corrosion, in view of the fact that this latter solution appears to be more expensive. The artificial production of a dense and closely adherent film which will at the same time be self repairing, is now considered by many specialists to be a solution of most corrosion problems. Both chromium and aluminium form stable surface films when exposed to sulphurated salt water, and are, therefore, of importance in the construction of condensing and cooling equipment for which no fresh water is available. Steel chromium alloys have proved to be more durable than carbon steel in the presence of corrosive sulphur compounds in pressure distillate.

Increased Heat Resistance of Metals

Regarding heat resistance of ferrous metals, the results collected during the past year or so appear to indicate that exposure to hydrogen sulphide and oxygen at service temperatures is a reliable test for determining whether a metal is suitable for a special duty. The reproduction of full scale conditions in the laboratory is very desirable, in view of the saving effected when reliable tests of this type can be performed. It has been shown that heat resistance can be increased by the use of chromium steel, but that the resistance does not increase proportionately with the chromium content above a certain figure, no appreciable additional improvement being observed when more than 4 per cent. chromium is present.

In pipe stills operating under severe conditions nickel has been used to stabilise the crystalline structure of the steel at high temperatures, but recent experience has shown that in several cases this has definitely reduced the resistance of the tube to heat corrosion, although a satisfactory explanation of this phenomenon does not appear to have been discovered. There have been many valuable publications on the use of silicon, aluminium and tungsten in steel for cracking still tubes, but no all-round alloy steel has been produced so far which could be universally adopted for all cracking units. As metal temperatures in modern distilling operations may reach 1,400° F., the changes in metal structure become of considerable importance, and designers have had to make use of inhibitors which retard these changes. Nickel has been proved an efficient stabiliser for austenite, and the percentage used does not in general exceed about 8 per cent.

Segregation of chromium carbide in the grain boundaries has been observed in tubes under severe temperature conditions. This is most undesirable, as it impoverishes the surrounding areas of chromium. However, tungsten has been shown to counteract this.

Analysis of Coloured Solutions

A Need for Collected Information

THE treatment of coloured liquids in analysis is a problem which is being rendered more acute as the use of dyestuffs in everyday life increases. At one time artificial dyes were confined almost entirely to such purposes as the colouring of textiles, leather, etc., but now they are known to be present in hundreds of other less likely products. Thus it comes that occasionally the problem before the chemist is not the utilisation of colour, but how to destroy it so that the usual tests dependent on natural colour change can be applied.

This subject, as pointed out by the "American Dyestuffs Reporter," has received little attention in the literature of dyeing although it is so closely connected with it, and what information there is appears to be scattered. There are a few methods of testing acidity of coloured solutions given in Mitchell and Hepworth's "Ink Manufacture," which might admit of more general application. As is well known, the amount of acid in an iron tannate ink is an important factor. Too much of it makes the fluid corrosive while too little makes it unstable and liable to form a sediment on keeping. A small quantity of free hydrochloric acid keeps the iron salts in the unoxidised, soluble form. One method sometimes employed, though by no means above criticism, is to put weighed steel nibs into a measured amount of the ink and find the loss in weight caused by the action of the acid. Another method, due to Mitchell, said to give better results, is that of distilling the sample with sodium acetate previously rendered neutral. The mineral acid present replaces acetic acid in equivalent amount and this being volatile is collected in the distillate and titrated. When any quantity of organic matter is present, three distillation processes are said to be required. Boiling the ink with 10-volume hydrogen peroxide under a reflux is a third method by which colour is said to be destroyed. ("Analyst," 1921, *46*, 131.)

A more recent contribution to the subject is due to Hibbard ("Ind. Eng. Chem.," July, 1932, p. 283). This method consists of destroying the colour by nascent bromine and the process is claimed to be applicable to dyestuff solution. In practice 50 cc. of the coloured solution is taken and to it is added 5 cc. of saturated bromine water and 5 drops of 5N caustic soda thus giving sodium hypobromite. To the mixture is then added 5 drops 5N hydrochloric acid. Free bromine is now evident: if it is not, the process is repeated. The excess halogen is removed by sulphite of soda or by boiling.

Letters to the Editor

The Ottawa Agreements

SIR,—Now that the Ottawa agreements are a working proposition, it occurs to me that the practical experience of your readers would be a useful commentary upon all that has been said for and against this great change-over.

Few will go as far as the critics who have been maintaining that the Dominions were getting everything and Britain next to nothing. Nevertheless, it may be that certain inequalities have arisen, for example, I believe there are classes of goods which are free of duty when imported into this country from a Dominion, but dutiable when imported from this country into some of the Dominions—if such cases exist the publication of them will be all to the good; each industry has, of course, the right to appear before its Tariff Board and state its case against injustice.

Incidentally, it would be well if all of us in this connection would get out of the habit of referring to the trade balance between two countries in terms of sterling. A million pounds worth of goods from a country paying its workers an average wage of, say, £3 a week is a very different proposition from the same value of goods from a country where the average wage is only £1. It is labour hours and standards of living which count.

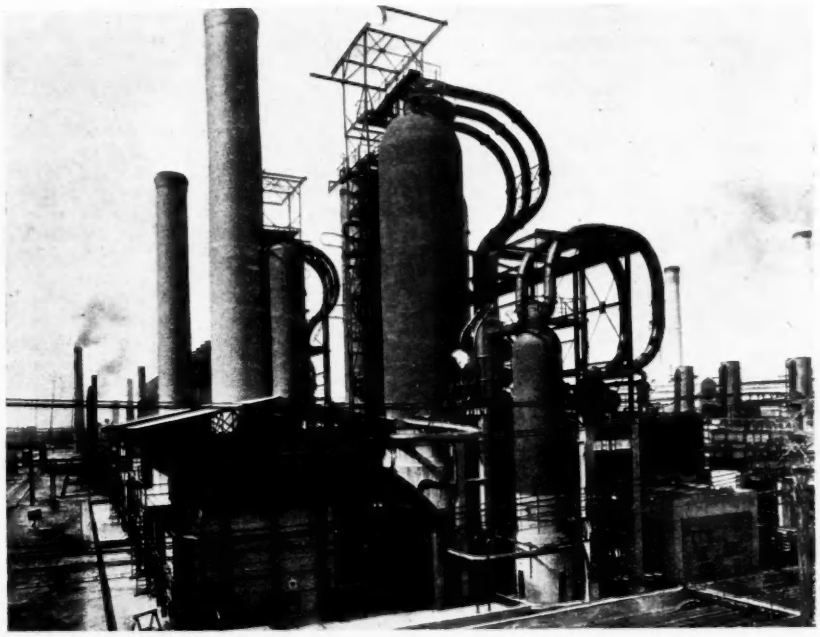
The menace of Japanese competition has been the subject of much discussion, and the Government has made some effort to deal with it. But what of possible competition from our own eastern territories with low wages and standards of living? Under the Ottawa agreement imports from these territories are entitled to the full benefit of the preferential position, even though the manufacture may be financed by foreign capital. Have your readers any experience of such competition? It would be of great interest to know.—Yours faithfully,

G. R. HALL CAINE,
M.P. East Dorset.

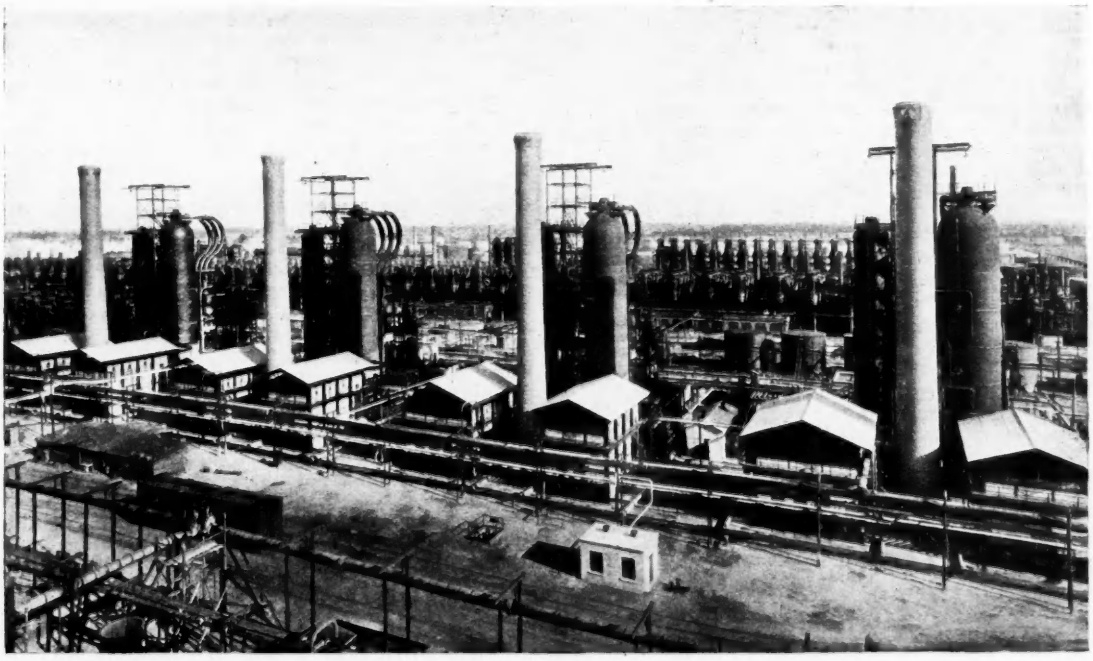
House of Commons.

THE I.G. Farbenindustrie, after making experiments with a new moth repellent, has now decided to give up production of this material. It appears that the cost of sodium selenate, which was to be used in the product, is too high to permit the manufacture at an economic price.

Modern Petroleum Distilling Units



Vacuum Flash Jug, operating in conjunction with a Two-Stage Atmospheric-Vacuum Distilling Unit flash



Four Two-Stage Atmospheric-Vacuum Distilling Units for Crude Oil.

Reproduced by courtesy of Foster Wheeler, Ltd., and the Institution of Petroleum Technologists.

Food Preservation Problems

Annual Report of the Food Investigation Board

MANY foodstuffs are now but the raw material of the food industry when they leave the producer, and quality, as the consumer knows it, depends no less upon such operations as the curing of bacon and hams, the smoking of fish, and the canning of fruit and vegetables, than upon production. All these secondary operations find their place, alongside the major problems of storage and transport, in the Food Investigation Board's programme of research, which thus has a direct bearing upon the standardisation of quality. The control of wastage during storage and transport from the producer to the consumer is also essential to orderly marketing, and though in the case of certain commodities a promising measure of control has already been achieved, in general little more than a beginning has been made. By assisting in the increasingly accurate definition of the conditions of transport and storage proper for each commodity, and in the determination of the best and most economical means for obtaining them, the work of the Food Investigation Board is therefore vitally linked up with this problem.

Torry Research Station

In the annual report of the Board for the year 1932 (H.M. Stationery Office, price 5s. net) it is stated that experiments at the Torry Research Station have now shown how brine-freezing can be practised with technical success for the commoner species of white fish. The solution lies in the temperature of freezing and storage. Fish must be frozen in brine at a temperature of −5° F., and must, moreover, be stored at a temperature lower than is ordinarily employed; for if a perfectly-frozen fish is stored at a higher temperature, such as, for instance, that commonly employed in commercial cold storage, namely, 15° F., it will deteriorate, and in a comparatively short time be no better than if it had been badly frozen at a high temperature. If, however, the correct temperature of freezing and storage is maintained, fish can be kept in a condition similar to that of fresh fish for three months; at the end of that period, deterioration begins to be noticeable. Having regard to the present state of the fishing industry, it is sincerely to be hoped that trawler-owners will give brine-freezing a practical trial at sea.

The board is also able to state that the commercial gas-storage of home-grown apples continues to expand. The accommodation for this type of storage has rapidly doubled, and now amounts to some 1,750 tons. Another 1,000 tons is known to be planned, and we have little doubt that, in a few years, the amount will be ten times what it is to-day. This accommodation is, of course, additional to that, amounting to some 8,000 tons, for the ordinary cold-storage of fruit. Encouraging preliminary results of experiments on the gas-storage of animal products are also reported. Progress in this new field has been rapid, and may be expected to lead shortly to exploratory trials under commercial conditions.

Storage of Meat and Fish

Work on the storage of meat and fish, which has been going on now for some years, has thrown a great deal of light on the relation between temperature and the rate at which tissues deteriorate in the frozen state. As a broad conclusion, the rate of deterioration is greatest at a temperature of −2° to −3° C., and decreases almost to zero at −20° to −25° C. This effect of temperature, which, be it remembered, is confined to the frozen state, is peculiar and unexpected. It has complex origins, three factors being concerned. The process of freezing itself is responsible for two of them. It increases the concentration of salt by removing water in the form of ice, and this in turn causes a change in the acidity of the tissue. Fall of temperature alone gradually decreases the rate of chemical change, and it is the interplay of these three factors that determines the rate of deterioration in storage at any given temperature.

Work has been continued on the changes in colour and in the fat of meat during storage, and on the effect of superficial infection by bacteria on the keeping of meat. Control of the degree of infection to which meat is subjected during handling is, indeed, almost as important as control of temperature in securing a reasonably long life in store.

Some remarkable experiments described in the report deal with the effects of substances given off as vapour during the ripening of fruit. Following upon an American observation that ripe apples placed among potatoes retarded sprouting, it has been discovered that the growth of young pea seedlings and other seeds is delayed or distorted by exposing them to air which has passed over ripe apples. The substance poisonous to the seedlings is present in very small quantities (about one part in 30,000). Although it has not been isolated in sufficient quantity to allow a complete chemical identification, evidence points to the active substance being either ethylene or a body of a similar nature. The remarkable fact has emerged that although the growth of the seedlings is prevented their rate of respiration is unchanged. The "apple air" has, however, quite a different effect on other apples. Apples and other fruit after being gathered are, of course, living bodies breathing out carbon dioxide. One secret of a long storage life is to keep their respiratory activity low, that is to make them live a quiet life and breathe slowly. In the storage life of all fruit there comes a time when a change takes place. The respiratory activity rises suddenly for a short time, falling again later. This change in the apple's life the scientist calls the climacteric. Apple vapour from fruit which has passed through the respiratory change immediately introduces this climacteric change in other fruit.

The Ripening of Fruit

This climacteric change is not peculiar to the apple. It occurs in tomatoes and in bananas. The yellowing of the skin and the softening and the sweetening of the flesh of a banana all take place after it has passed through the climacteric change. The active substance given off by apples has been found to hasten the ripening of green bananas and young apples. There is also indirect evidence which suggests that bananas themselves, during part of their life, produce an active substance. The fact that the ripening of bananas could be slowed down by air with a lower proportion of oxygen was stated in the last report issued by the Board. An apparatus was, therefore, constructed by which a lower proportion of oxygen could be obtained without the accumulation of carbon dioxide. In experiments with this apparatus, now described, the low proportion of oxygen failed to slow ripening and the fruit ripened as rapidly as in air. The report suggests that the reason may lie in the method of ventilation. In the previous experiments the air was supplied in an open stream so that volatile substances given off by the fruit could not accumulate. In the plant now constructed the air ran in a close circuit so that such products could accumulate. These results seem to suggest that the volatile products from the bananas counteract the effect of the reduction in oxygen.

It is pointed out that the study of the effects of "apple air" on apples and other fruit and the influence of the climacteric changes may lead to a clearer understanding of many of the diseases occuring in fruit which constitute serious practical problems in its storage and handling. The internal browning of apples, for example, is associated with too low a temperature while passing through the climacteric. The development of superficial scald—browning of the skin—appears to be determined during this critical period, which also seems to be connected with the injurious effects of too much carbon dioxide in the atmosphere of the store. Further studies are to be made of the relation to the climacteric period of other storage diseases of apples which can be avoided by gathering at the correct degree of maturity.

Canning Corrosion Troubles

In continuation of the studies on the corrosion of tinplate, it has been shown that while small quantities of tin in solution retard the rate of corrosion of iron by acids, small traces of ferrous salts, and to a lesser degree those of copper, increase the rate of corrosion of tin in the presence of oxygen. The action of ferrous salts on the rate of corrosion of iron itself is similar. The scope of the work on corrosion has been

widened by the inclusion of a survey of the metals used in the construction of plant for the manufacture of fruit-products, and the extent to which copper, aluminium, nickel, monel metal, stainless steel, silver, tinned copper, silver-plated copper and chrome-nickel alloy are attacked by citric acid in the cold has been determined. The effect of these metals on the anthocyanin pigments of typical fruits has also received attention, and it has been shown that most of them cause little or no discoloration when present in small quantities. This is unfortunately not the case with the metals of tin-plate, since tin causes much trouble with fruits rich in pigments, such as black-currants, while iron, on the other hand, acts on tannins and allied substances, and has a great effect on fruits poor in pigments, such as strawberries.

Fish Drying

While empirical experiment on the smoking of fish has yielded results of undoubted practical importance, in particular in permitting the attainment of greater control of the process, it has become clear that deeper analysis is required before a further advance can be made. Drying, as distinct from flavouring and colouring, is an essential part of the process, and preliminary experiments have been undertaken in a wind-tunnel with a view to assessing the relative importance, in drying, of the three factors, temperature, relative humidity and rate of movement of the air. The results are interesting and suggestive, but do not as yet justify more than the broad statement that all three factors are concerned in determining the rate at which fish loses weight, *i.e.*, dries.

The chemical classification of the oils and fats of fishes has been continued, and has included a study of the fats of the porpoise. Lauric acid has been found in the blubber of this marine mammal, and the observation appears to be new. An endeavour is also being made to determine the extent and the causes of the fluctuations in the potency as regards vitamin A of the oil from the halibut's liver. The causes of the sudden large fluctuations cannot be correlated with the position of the fishing ground, with the food of the fish (as indicated by the contents of the stomach), with the glycogen in the liver (as indicating the fish's general state of health), nor with change in season, though all the exceptionally rich oils were derived from fish caught during the month of May and were absent in fish caught in any other month. Edisbury's interesting discovery that during the summer of 1932 there was a large seasonal increase in diatoms in the Irish Sea about a fortnight before the exceptionally rich oils were found, is now being followed up.

The investigation of the breakdown of glycogen and the accumulation of lactic acid in fish's muscle after death has made good progress. The relative amounts of glycogen and lactic acid found in muscle after four day's storage at a temperature of $-10°C.$ appeared to indicate an unexpectedly high rate of change at this temperature. Further investigation, however, showed that most of the change actually occurred during freezing, and that once the temperature of the muscle reached $-10°C.$, further change was exceedingly slow. An important by-product of the general investigation of the oils and fats of fish is the discovery of the active principle now used in the treatment of pernicious anæmia.

Phosphoric Acid and Phosphates

Manufacturing Processes in Germany

In outlining the most suitable procedure for the manufacture of pure phosphoric acid and sodium phosphate ("Metallbörse," July 26, 1933, p. 942) Dr. Kufferath strongly advises against the use of raw phosphate as the starting point. Not only is the violent frothing of the reaction mixture, which occurs on stirring with sulphuric acid, a grave source of danger to the personnel, but the entire fluorine content goes to waste. The addition of sulphuric acid must therefore be gradually effected with consequent prolongation of the time involved. Incidentally, the dissolved fluorine salts may destroy the porous stone during filtration if these are constructed of quarts. Danger of corrosion can be prevented, it is true, by using the so-called "brandol stone" (a bakelite composition), or the more recently introduced carbon filter masses which combine high resistance to corrosion with a mechanical strength bearing comparison with that of the best porous stone.

Superphosphates as Raw Material

Superphosphate is indisputably the sole material entering into consideration as the starting point for an economical practicable phosphoric acid process. It is stirred in a pitch pine vat with boiling water containing the requisite amount of sulphuric acid for conversion of the calcium present into calcium sulphate. A stirrer of the lattice or propellor type is recommended and those parts which are most exposed to wear are preferably constructed of lignum vitae. Non-corrosive steel is only suitable for the stirrer when sufficiently resistant to the abrasive action of the superphosphates. Heating is effected wih dry steam through a thick-walled lead tube passing to the floor of the container. Waste steam escapes through a series of side tubes. Only about two hours are involved in the digesting operation. After the digesting operation the contents of the stirrer are at once led off into at least two wooden vats fitted with fine-pored filter stones, the pore diameter of which should be about 0.015 mm. Rapid filtration takes place and the filtrate flows into homogeneously leaded pressure vessels whence the crude phosphoric acid (specific gravity 1.12 to 1.15) is either pumped to the stirring plant in which it is treated with alkali salt or to the evaporating apparatus. In the latter it is concentrated to a specific gravity of at last 1.2 in homogeneously leaded Frederking boilers. On passing into large shallow lead-lined iron containers, the dissolved gypsum and a certain amount of calcium monophosphate settles out.

In this process it is of the utmost importance to add an exactly calculated amount of sulphuric acid during the digestion. Preferably rather less than the theoretical amount should be added at this stage, so as to reduce the number of sulphate ions in the final alkali phosphate.

Conversion of Acid to Phosphate

Conversion of technically pure phosphoric acid to secondary sodium phosphate is now practised on an extremely large scale since this salt serves as the raw material for other important sodium phosphates. During neutralisation, calcium, iron, aluminium and magnesium are precipitated as phosphates, while a small addition of sodium sulphate leads to elimination of arsenic. When the reaction is completed and carbon dioxide has been driven off, it is advisable to add a small proportion of decolorising carbon to absorb the organic matter originally present in the superphosphate. The hot reaction mixture is passed into a pressure vessel fitted with stirring gear and from there forced through a filter press; it is then washed with a little hot water and the filter cake subjected to preliminary drying in the press for a few minutes with a compressed air blast, when it is more readily detached from the cloth. After drying, the precipitate forms a valuable fertiliser for fruit cultivation and compares favourably with the best Thomas meal with a 35 per cent. phosphorus pentoxide content.

The filtrate, together with the earlier batches of washing water, are brought into iron containers fitted with cooling coils and cooled to about 12°C. with stirring. The moist crystals of secondary sodium phosphate are centrifuged and air-dried in a rotating drum at ordinary temperature. Water of crystallisation can only be cheaply removed with the aid of the rotary drier. When sufficiently concentrated, the hot solution should be transferred without delay to a hot water-jacketed storage tank situated above the rotary drier. The drum can be safely maintained at 150° C. since decomposition to pyrophosphate only begins at about 240° C. The anhydrous salt removed from the rollers with the scraping knife falls into a heated chamber fitted with a travelling worm and emerges as a white homogeneous fine granular powder.

Institution of Chemical Engineers' Examinations

Associate-Membership Papers, 1933

THE annual examinations for associate-membership of the Institution of Chemical Engineers were held on July 13 and 14, and were preceded by the usual home papers earlier in the year. We reproduce this year's examination papers below.

Home Paper—Section A.

1. Prepare a detailed scheme for the manufacture of 3 tons of 98 per cent. acetic acid per day of 24 hours from grey acetate of lime, assuming a market to be available for a reasonable quantity of 30 per cent. technical acetic acid. Submit detailed flow-sheets showing balances of materials, heat and other forms of energy, and time. Calculate, as far as possible from first principles, the main dimensions of all essential parts of the installation, specifying the materials to be used. Give an approximate estimate of the capital outlay, and of the cost of production. Prepare a general arrangement drawing of the whole plant, and a working drawing, technical specification and detailed cost estimate for one of the reaction vessels employed.

2. Discuss briefly and critically the methods which have been proposed for the removal of tar and phenol from ammonia liquor. Prepare a detailed scheme for the treatment of the liquor from a coke oven plant carbonising 700 tons of coal per day of 24 hours. Submit detailed flow sheets showing balances of materials, heat and other forms of energy and times. Calculate, as far as possible from first principles, the main dimensions of the installation. Give an approximate estimate of the capital outlay and cost of operation. Prepare a general arrangement drawing of the whole plant, and a working drawing, specification and detailed cost estimate for one of the special vessels you would use.

3. Prepare a detailed scheme for the manufacture of 4 tons per day of 8 working hours of mononitrotoluene from toluene, nitric acid and sulphuric acid. Submit detailed flow sheets showing balances of materials, heat and other forms of energy, and time. Calculate, as far as possible from first principles, the main dimensions of all essential parts of the installation. Give an approximate estimate of the capital outlay and of the cost of production, assuming a value for the waste acid of 25s. per ton. Prepare a general arrangement drawing of the whole plant, showing clearly any special precautions you would take in handling the various materials, and give a working drawing, technical specification, and detailed cost estimate for the nitration vessel and its accessories which you would employ.

4. Prepare a detailed scheme for the manufacture of metallic magnesium from anhydrous magnesium chloride suitable for an output of 5 tons per day of 24 hours. Submit detailed flow sheets, showing balances of materials, heat and other form of energy, and time. Calculate, as far as possible from first principles, the main dimensions of all essential parts of the installation. Give an approximate estimate of the capital outlay and of the cost of production. Prepare a general arrangement drawing of the entire plant and a working drawing, technical specification and detailed cost estimate of the type of reaction vessel you would employ

Section B.

1. A mixture containing 30 per cent. by weight of methyl alcohol and 70 per cent. by weight of ethyl alcohol is to be separated by continuous distillation into methyl alcohol and ethyl alcohol, each of 95 per cent. purity (by weight). Plot a curve showing the relationship between the number of ideal plates required and the heat consumption, assuming the feed to be at boiling point. Mixtures of methyl alcohol and ethyl alcohol may be assumed to follow Raoult's Law. Indicate approximately the limits between which you would expect the reflux ratio to lie in practice.

2. Write a critical essay on "Temperature Measurement," indicating the range of application of instruments of different types, the accuracy obtainable and the precautions necessary in practice to ensure accurate results.

3. Describe the methods that are employed in industry for removing suspended dust or mist from large volumes of gas.

4. Prepare a scheme for the complete treatment of boiler-feed water to render it non-scaling and non-corrosive, for use in a water-tube boiler generating 40,000 lb. of steam per hour at a working pressure of 250 lb. per sq. in. gauge. 90 per cent of the steam is condensed and returned to the hot well at a temperature of 40° C.; the remaining 10 per cent is used in process work and not returned. The hot well is open to the atmosphere. The "make up" water is at an initial temperature of 10° C.

Analysis of "make up" water is:—

	Grains per gal.
Total dissolved solids	111.3
Alkalinity (calculated as calcium carbonate):	
as bicarbonate	12.39
as carbonate	nil
as caustic	nil
Total	12.39
Chlorine	21.04
Sulphuric anhydride	33.41
Nitric anhydride	1.77
Silica	0.64
Lime	1.6
Magnesia	8.42
Ammonia	0.28

Estimate the probable combination and give the nature and weight of chemicals you would propose for its treatment, and give sufficient details of a suitable softening plant to enable a draughtsman to prepare working drawings. Indicate clearly how you would propose to remove the dissolved oxygen from the water, assuming that the O_2 content of the "make up" water is 7 c.c. per litre.

Examination Paper—Section C—Part I.

1. Water is flowing through a vertical pipe, of 5 in. internal diameter, at the rate of 200 gal. per min. The pipe contains a plate having a 3 in. diameter centrally situated sharp-edged orifice. Calculate the pressure drop shown by manometer, connected to the pipe on opposite sides of the plate at points 1 ft. vertically apart.

2. Give the equation of Bernoulli's Theorem in a form applicable to the flow of compressible fluids, and derive therefrom expressions from which the velocity of flow and the mass velocity can be calculated for air, assuming that the approximate adiabatic equatation

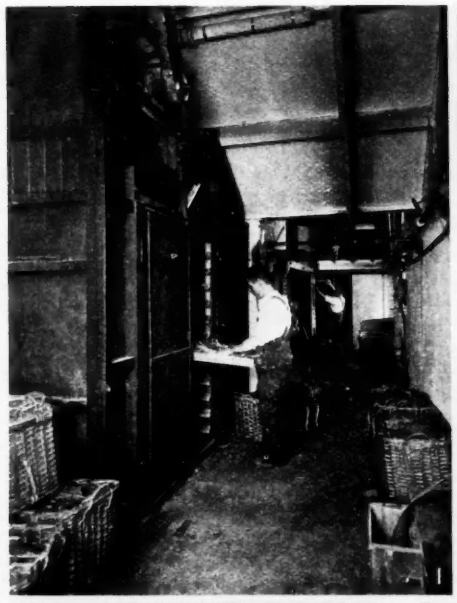
$$pv^{\frac{1}{2}} = \text{constant}$$

will apply. Show that the mass velocity through an orifice will have a maximum value when the pressure on the exit side is approximately 0.54 of that on the entry side, and compute the linear velocity under these conditions when the pressure on the entry side is 1 kg. per sq. cm. abs. and the density of air is 1.17 kg. per cu.m.

3. A cooling coil consisting of 10m. of pipe 25 mm. bore is placed in a tank of liquid, the heat losses from which may be neglected. Water is passed through the coil at constant velocity of 2m. per sec., and it may be assumed that the overall coefficient of heat transfer is 1,000 kg. cal./sq. m./hr./°c. thriughout. Assuming that the liquid in the tank is uniformly at 100° C. and that the water enters the cooling coil at 20°., calculate the outlet temperature of the water and the efficiency of the coil. Calculate approximately what changes in efficiency would be produced by lengthening the coil to 40 m. length and 100 m. length.

4. Calculate the theoretical H.P. required for compressing 200 cu. ft. per min. of free air to pressures (gauge) of 70 and 200 lb. per sq. in. respectively. Indicate briefly any differences in the equipment you would employ in the two cases and estimate the power required in practice.

5. Producer gas is used as fuel for an internally-heated kiln calcining a product which gives off carbon dioxide and water during calcination. The analyses of the exit gases and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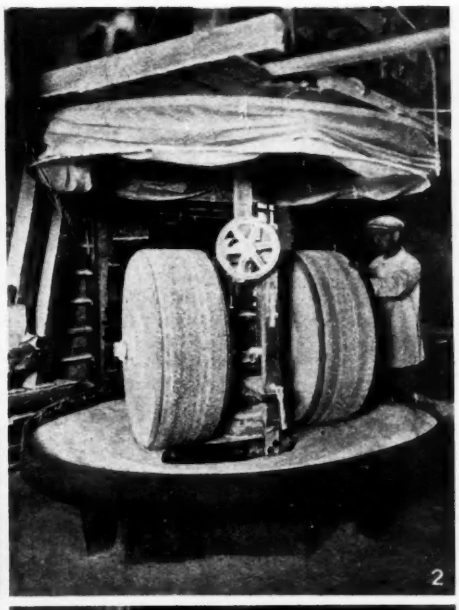
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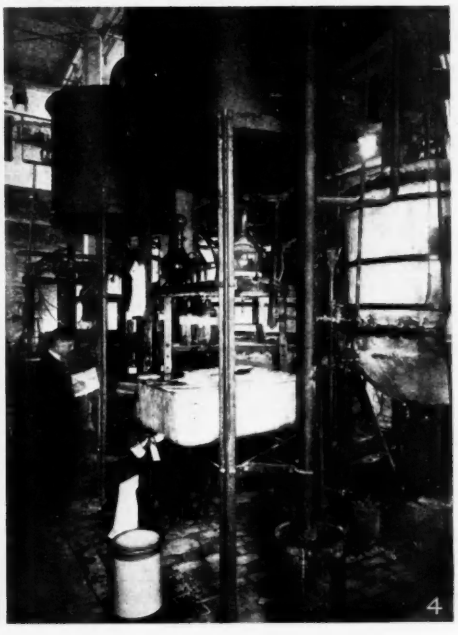
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THE centenary of Stafford Allen and Sons, Ltd., of London, and Long Melford, has been marked by the publication of a souvenir brochure from which the above illustrations are reproduced. This firm came into existence in 1833, with the definite object of remedying a particular evil of the day, namely, drug adulteration. At their headquarters in Cowper Street, Finsbury, on the site upon which the company was established, there are grinding mills, distilleries and analytical laboratories. Originally planned for the milling of drugs and spices, and for the distillation of essential oils, these works have been modified and enlarged at different times during the intervening one hundred years, and today there is scarcely any essential oil, drug or spice—English or exotic—which does not enter the premises in the normal course of business. Stafford Allen and Sons were the first to distil sandalwood oil on a commercial scale, and this they did at Cowper Street very soon after the company was established. They have also gained a world-wide reputation for English almond oil, and for essential oils from such herbs as peppermint, lavender and chamomile, all of which are grown on their own farms at Long Melford, Suffolk. Our illustrations show (1) one of the drying rooms for drugs ; (2) an edge runner mill in the drug grinding department ; (3) the operation of cutting-up sandalwood prior to distillation ; and (4) a corner of one of the still rooms.

the producer gas are given below. Calculate the percentage of excess air used for combustion.

Composition of producer gas.		*Composition of exit gases.*	
CO_2	6.5%	CO_2	25.1%
CO	27.0	O_2	5.3
H_2	12.0	N_2	69.6
CH_4	0.5		
N_2	54.0		

Section C—Part II.

6. Oil is pumped through a straight pipe 6 cm. internal diameter 100 m. long at the rate of 32,400 kilos per hour. The net power consumption for overcoming frictional resistances alone is 7.5 H.P. Given that the density of the oil is 0.9, calculate the average coefficient of viscosity.

1 H.P. = 746×10^7 ergs per sec.

7. The following liquids are to be elevated to a height of 50 ft. at the rate of 800 gal. per hour:—(a) Water containing sand in suspension; (b) 90 per cent. acetic acid (cold)—S.G 1.07; (c) molasses—S.G. 1.45; (d) 15 per cent sodium carbonate solution (hot)—S.G. 1.14. State what type of apparatus and materials of construction you would employ in each case, giving the reasons for your choice. What, approximately, would be the H.P. required in each case?

8. Calculate the dimensions of cross section of a bare copper conductor to carry a current of 10,000 amps. subject to the condition that the temperature of the conductor shall not rise above 35° C. when the surrounding temperature is 20° C. Calculate the voltage drop per 100 ft. run. Loss of heat from a copper surface

$$=0.2(T_s^4-T_a^4)10^{-8}+3(T_s-T_a)^{1.25} \text{ kg. cals./sq. m./hr.}$$

Where T_s = abs. temp. °C. of surface.

T_a = ,, ,, surroundings.

Resistance of copper at 20° C. = $\frac{1}{58}$ ohm. for 1m. length, 1 sq. mm. section.

Temperature coefficient of resistance = .004 per °C.

1 Kwh = 860 kg. cals.

9. The compressor of a refrigerating plan takes 20 B.H.P. The evaporator of condenser temperatures are 15° F. and 70° F. respectively. The efficiency of the compressor is 70 per cent. Assuming a reversed Carnot cycle as an approximation, calculate the volume of brine that can be cooled per hour from 35° F. to 22° F.

S.G. of brine = 1.28.
Sp. heat of brine = 0.74.
1 H.P. hr. = 2546 B.Th.U.

10. Describe briefly the main types of instruments used for checking the efficiency of combustion in a boiler plant by the composition of the flue gases. State what you consider to be their relative advantages or disadvantages.

Section D—Part I.

1. How would you determine the filtering characteristics of a given slurry? Discuss briefly the advantages and disadvantages of:—(a) A filter press; (b) a leaf filter; (c) a rotary filter. State what type of filter you would propose in each of the following cases:—(i) To clarify a vegetable oil after neutralising the free fatty acids; (ii) to separate precipated calcium sulphate from a concentrated solution of phosphoric acid; (iii) to separate fine salt crystals from a hot mother liquor.

2. Describe briefly with rough sketches the equipment required for (a) the evaporation of a saturated solution in double effect; (b) the evaporation of a dilute solution in triple effect with forced circulation. State the effect upon evaporative capacity and economy of (i) boiling-point rise; (ii) multiple effect working; (iii) vapour recompression.

3. Write a short technical report, describing the essential features of some industrial process in which you are particularly interested.

4. Discuss the physico-chemical principles involved in either (i) the manufacture of synthetic methanol; or (ii) the hydrogenation of coal tar. How are these principles applied in industrial practice? Illustrate your answer by a diagrammatic flow sheet of the plant.

5. Describe a ball mill, indicating in particular the steps that can be taken (a) to obtain a uniform product, (b) to prevent contamination; (c) to obtain the maximum grinding efficiency. How would you calculate the critical speed of the ball mill and approximately the H.P. required?

Section D—Part II.

6. What factors would have to be considered in designing a plant for producing 2,000 cu. ft. of electrolytic hydrogen per hour with a maximum of economy?

7. Describe the mechanism of the drying of a wet solid, illustrating your answer by reference to the drying of (a) loose salt crystals; (b) lumps of whiting; (c) slabs of soap.

8. In the rectification of a mixture of alcohol and water, what factors determine (a) the capacity of the still and column; (b) the degree of rectification that can be obtained; (c) the amount of steam that is consumed?

9. Describe, with sketches, giving the principles of operation, the type of plant which you would recommend for *any three* of the following operations on a commercial scale (a) the absorption of chlorine gas by NaOH to produce a concentrated hypochlorite liquor; (b) the emulsification of bitumen in water; (c) the separation of tar fog from producer gas; (d) the extraction of magnesium as bicarbonate from a mixed precipitate of magnesium hydroxide and calcium carbonate; (e) the production of commercial sodium chloride from sea water.

10. Give an account of the two-film theory of gas absorption. How can the theory be applied to the design of an absorber (a) for ammonia; (b) for sulphur dioxide?

Section E—Part I.

1. (Compulsory question). Indicate in six only of the following cases:—(i) Generally and briefly the type of apparatus you would employ under normal conditions in large scale practice. (ii) In detail, the materials of construction, and, generally, the type of fabrication of the plant (*i.e.*, riveted, welded, cast, forged, etc.). (iii) Roughly, the length of life of the particular portion subjected to severe corrosion. (a) Base-exchange type water soften and tank for the regenerating brine. (b) Pickling tank and baskets for treatment of mild steel articles with warm dilute H_2SO_4. (c) Storage tank for cold 70 per cent. acetic acid. (d) Agitator vessel for a solution containing 30 per cent. H_2SO_4 at temperature of 100° C. (e) Crystallisation of copper sulphate. (f) Pumping cold 65 per cent. nitric acid to a height of 30 ft. (g) Screening a hard gritty non-corrosive material through 8 mesh. (h) Tube mill for pulverising chromite for production of chromates. (i) Transporting strong nitric acid in large quantities by rail. (j) Denitrating waste acid from manufacture of aromatic dinitro compound. (k) Removing arsenic from sulphuric acid. (l) Decomposing NaCl with H_2SO_4. (m) Evaporating oxalic acid. (n) Saturation of sulphuric acid with ammonia in the production of ammonium sulphate. (o) Washing crude benzol with sulphuric acid.

2. Write a specification such as you would send out to a manufacturer with an inquiry for a lead-lined steel plate montejus or acid egg for elevating sulphuric acid of 60 per cent. strength, to be suitable for a maximum working pressure of 45 lb./sq. in., capacity 78 cu. ft. State what fittings you would require for use with this and give a rough sketch showing how you would install the arrangement.

3. Describe briefly the most important welding methods employed in the construction of chemical plant, and describe clearly the operations which would be involved in constructing a simple benzene storage tank of, say 9 ft. diameter by 30 ft. long.

4. Describe an air-compressing installation suitable for producing a steady supply with a maximum pressure of 80 lb. per sq. in. at a maximum rate of 250 cu. ft. of free air per min. What arrangements would you provide for driving the compressor?

5. State what enquiries you would make before purchasing electric motors for a works obtaining power from a supply company. Describe what arrangements you would specify for driving a vacuum pump with a 15 h.p. motor, assuming a 3-phase A.C. supply, and give particulars of control and starting gear required.

Section E—Part II.

6. Write a short essay on profit-sharing schemes in industry.

7. Discuss the uses of rubber-lined vessels in the chemical industry.

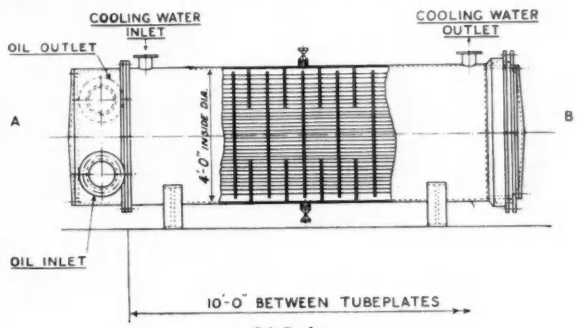
8. What are the main differences between conducting a business as a partnership and as a limited liability company?

9. A single-effect evaporator for exaporating 5,000 lb. of water per hour from a solution of a salt costs £1,200. The cost of steam is 1s. 6d. per 1,000 lb. If 1 lb. of steam can evaporate 0.75 lb. of water per effect, what number of effects should be installed to give the lowest operating cost and what would be the annual saving in this case compared with using a single effect? Neglecting variations in the cost of auxiliary plant, the capital cost of the evaporator may be taken as proportional to the number of effects. Allow 15 per cent. on the capital cost for depreciation and repairs, 6 per cent. for interest and 20 per cent. for other overhead charges. The cost of labour may be taken as the same for any number of effects. Assume 300 working days of 24 hours in the year.

10. Explain the meaning of the following terms:—Consolidated balance-sheet, holding company, debenture, fixed assets, floating assets, current liabilities.

Section F.

Oil Cooler.—Tube battery consists of six passes, each pass consisting of 60 tubes of $1\frac{1}{4}$ in. bore. The end at B is fitted with a cover so that internal surfaces of the tubes may be cleaned without dismantling, and the chest at the end B passes through a gland so that stresses due to unequal thermal intended to permit of the tube nest being withdrawn from end A. Candidates are required: (1) to draw a sectional expansion may be avoided. The construction is, moreover,



Oil Cooler.

elevation showing full details of the end B, (2) to draw end elevation of one end with cover removed, showing details of tube pitching and passes. Drawings should be made to the scale of $1\frac{1}{2}$ in. = 1 ft.

Studies on Enzyme Action

By JOHN ORTON PAGE

We give below an abstract of a thesis submitted in partial fulfilment of the requirements for the Degree of Doctor of Philosophy in Chemistry at the Graduate School of the University of Illinois, 1933.

OBSERVATIONS that ethylene and many other substances have the faculty of hastening the ripening of fruits, breaking the rest period of tubers, and similar phenomena associated with chemical and physical changes in plant materials have made possible a number of improved commercial processes. Harvey ("Univ. of Minn., Agr. Exp. Sta., Bulletin 247," 1928) has prepared a review of the literature with reference to the ethylene treatment of fruits and has made several experimental contributions to the subject. In general, the phenomena have been attributed to alteration in the enzymic activity of the plant material. Denny has classified the effects with respect to enzymes into two principal groups. In one the influence is direct in that the change in rate of reaction is produced by the ethylene or other reagent after the enzyme is separated from the living tissue. In the other, the effect is indirect in that the living tissue is treated with the reagent and the enzyme later separated and examined. Denny ("Contributions from Boyce Thompson Institute for Plant Research," 1932, *4*, (No. 1) 53-64) has shown that there is no close connection between direct and indirect effects.

The designation of an increase in the rate of transformation of a substrate by an enzyme as "activation" has been criticised by Nord ("Mechanism of Enzyme Action and Associated Cell Phenomena," Baltimore, 1929, p.26) as meaningless. Noel and Franke ("Protoplasma," 1928. *4*. 547) have presented evidence that in the case of ethylene treated zymase, the increase can be explained by an alteration in permeability of the cells and a protector action upon the colloidal enzyme material. Nord infers that the same explanation may be quite generally applied to other enzyme systems and considers that some results obtained by Englis and Zannis ("J. Am. Chem. Soc." 1930, *52*, 797) upon amylase and invertase are in contradiction to his observations. The experiments just mentioned were concerned only with direct effects while those of Nord were concerned with indirect effects.

Direct and Indirect Effects

The enzymes selected for study were invertase, amylase, bromelin, erepsin, oxidase, and peroxidase. These may be considered as representative of the group concerned with the reactions characteristic of the ripening of fruits.

The general procedure for examination of the direct effects was to obtain the enzyme from a convenient source in relatively pure condition. The reaction rate of a portion upon its appropriate substrate was then determined and compared with that of another portion whose substrate, or the complete system, had been subject to treatment with ethylene or similar reagent. For the indirect effects, tomatoes were chosen as the fruit. They were grown under both field and greenhouse conditions. Samples were picked so as to be representative of different stages of immaturity. The samples were divided into two lots one of which was treated with ethylene and the other maintained as a control. When the treated lot was apparently ripe, the juice was expressed and the activity of enzymes of the juice was compared to that of the untreated lot of the same initial quantity. Comparison was also made to a lot which had been vine ripened.

Effect of Ethylene Treatment

Ethylene had no apparent direct effect upon invertase, amylase, bromelin and erepsin. No phenomenon which could be described as a protector action, or narcosis, was observed. Invertase, whether purified by dialysis or left in the undialysed condition, was inhibited by large concentrations of potassium cyanide. Small concentrations of potassium cyanide were without influence. A low concentration of potassium cyanide 10.0 mg. per 100 cc. of reaction mixture, appears to enable amylase to resist inhibition of activity produced by rise of the pH value. In such small amounts it also stimulates the activity of the enzyme. In concentrations of 50 mg. per 100 cc. the potassium cyanide inhibits the activity of the amylase. Dialysis of malt amylase extracts caused the loss of some constituent which is responsive to potassium cyanide.

With the indirect study involving the ethylene treatment of tomatoes, three experiments gave results indicative of some stimulus of invertase action while in three other experiments inhibition was evident. These differences may be attributed to some factors associated with cultural conditions of the plants. In every case, the invertase activity in a naturally (vine) ripened tomato is much greater than in the ethylene treated fruit. In agreement with previous workers, it was observed that the reducing sugar content of a tomato ripened on the vine is greater than that of the ethylened tomato and that the flavour of ethylene treated tomatoes is satisfactory. The acidity of the fruit is not lessened by treatment. The commercial utility of ethylene is limited to fruits which would not develop a red colour on the vine for a considerable time. The concentration of direct oxidase is negligible in the tomato.

Data on peroxidase studies is limited but indicates no definite correlation with ethylene treatment. The lack of correlation between the direct and indirect effects of ethylene upon invertase action indicates that an explanation based upon simple physico-chemical influences, such as permeability and protector action, is not probable.

Analysis of Coal Ash

Importance of Determining Minor Elements

IN connection with the physical and chemical survey of the national coal resources, the Department of Scientific and Industrial Research has issued a fuel research survey paper* dealing with the method of analysis of coal ash. This report does not purport to be a treatise on the subject, but is put forward—in the absence of any recognised scheme for the analysis of coal ash—in the hope that it will form a basis upon which to build a complete collection of methods for all types of coal ash and all constituents that may occur in them. To this end suggestions for improvements and extensions of the methods are invited.

Coal ash consists of a complex mixture of elements, mainly present as oxides, or in combination with silica as silicates, and generally some sulphates. The report deals with the determination of the commoner of these, which constitute the major part of most ashes. The methods described have been selected, after extended trials and with such adaptations as experience has shown to be desirable, from those already recognised for the analysis of silicate rocks and other materials similar in composition to coal ash. Methods are given for the separation and estimation of silica, iron, titanium, aluminium, calcium, manganese, magnesium, phosphorus, alkalis and sulphur trioxide. Of these, the precipitation of titanium by "cupferron" solution is an interesting example of the newer practice of employing organic reagents in place of inorganic reagents. In addition to these major constituents, there occur smaller and variable amounts of constituents which may have an important bearing upon the properties and use of the coal. Methods for the determination of some of these are still under investigation and are therefore not included in the report.

Many other elements, some of them classed with the rare elements, have been detected from time to time in coal or coal ash, and an appendix gives a bibliography of reported occurrences of these. Formerly their presence was mainly a matter of purely scientific or academic interest, but in view of their possible action as catalysts in certain processes of coal utilisation (*e.g.*, hydrogenation), their detection and determination has recently assumed considerable practical importance. Since they occur generally in small amounts—often mere traces—this is likely to be a matter of considerable difficulty, but the report states that the progress already made in spectrum analysis indicates that this may prove a satisfactory and rapid method of determining not only the presence but also the amounts of certain of these elements.

The Ceramic Society

Autumn Meeting of Building Materials Section

THE autumn meeting of the Building Materials Section of the Ceramic Society, will be held at Exeter, September 13—15. On Wednesday, September 13, there will be a visit to the works of the Cattybrook Brick Co., manufacturers of building and engineering bricks, whose managing director, Mr. E. Gwynne Vevers, is president of the Society. Papers to be presented at a meeting at University College, Exeter, on Thursday morning, include: "The Conditioning of Clay in the Plastic State" (H. F. Clews), "Petroleum—from Well to Consumer," including the selection of oils for use on brickworks (F. J. Slee), "The Permeability to Air and to Water of some Building Bricks" (E. O. Mills). In the afternoon there is to be a visit to Candy's fireclay and tile works at Newton Abbot. On Friday further papers will be read at a meeting at University College, Exeter, followed by a visit to Bridgwater, where members are to be the guests of the South Western Brick and Tile Federation at a luncheon at the Royal Clarence Hotel. There will also be a visit to the works of the Somerset Trading Co., who are important manufacturers of roofing tiles.

* "Fuel Research, Physical and Chemical Survey of the National Coal Resources, No. 28: Methods for the Quantitative Analysis of Coal Ash." H.M. Stationery Office. Price 6d. net.

Lawn Tennis Tournament

The Final Matches

THE semi-final round of the singles in the Chemical Industry Lawn Tennis Tournament, arranged by THE CHEMICAL AGE, was completed this week, but owing to the difficulties of travelling the doubles match between Pennington and George (J. Crosfield and Sons) and Giltrow and Hammond (Williams, Hounslow, Ltd.) has been postponed until September 9. Both of the matches in the semi-finals of the singles ran into three sets. Grape was beaten by Copp, who was a semi-finalist in the doubles in last year's tournament. Pennington and George, who, up to the present, have been successful partners in the doubles, were drawn against each other in the singles semi-final and the match resulted in a victory for Pennington, who will now meet Copp in the final match of the tournament on September 16. Haines and Hawley won their match with Alldis and Perridge, in two sets, which brings them into the finals without having lost a single set throughout the competition. They are newcomers to the tournament this year and their final opponents will be either Giltrow and Hammond, last year's runners-up, or Pennington and George, the Warrington players, also entering the tournament for the first time, who knocked out the 1932 winners, Chaloner and Speakman, in the first round this year.

The results of the semi-final matches received to date are as follows:—

SINGLES.

C. G. Copp (Doulton and Co., Ltd., London) beat L. F. Grape (Borax Consolidated, Ltd., London), 2—6, 6—2, 6—4.

R. C. Pennington (J. Crosfield and Sons, Ltd., Warrington) beat R. George (J. Crosfield and Sons, Ltd., Warrington), 3—6, 6—0, 6—0.

DOUBLES.

F. G. Hawley and J. Haines (Anglo-Persian Oil Co., London) beat W. L. Alldis and S. B. Perridge (Brandhurst Co., Ltd., London), 6—3, 6—0.

Arrangements for the Finals

By the kind invitation of Johnson, Matthey and Co., Ltd., Hatton Garden, the finals are to be played at that company's courts at the Toll Gate, College Road, Dulwich, on the afternoon of Saturday, September 16. THE CHEMICAL AGE silver challenge doubles cup, which was won in 1931 by S. Newman and E. J. Lawrence ("Industrial Chemist") and in 1932 by S. E. Chaloner and W. Speakman (Monsanto Chemical Works, Ltd., Ruabon) will be presented to the winners of the doubles, to be held jointly for one year, and a handsome new trophy, THE CHEMICAL AGE silver challenge singles cup, will be presented to the winner of the singles for one year. In addition there are six solid silver cups to be won outright. Three "Invicta" cups, presented by Thomas Hill-Jones, Ltd., will be awarded to the two winners of the doubles and the winner of the singles respectively, while three "Lloyd-Willey" cups of similar pattern will be given to the two runners-up in the doubles and the runners-up in the singles.

The finalists will be as follows:—

SINGLES.

Copp, C. G. Doulton & Co., Ltd., 28, High Street, Lambeth, London, S.E.1. (Reliance 1241.)	*v*	**Pennington, R. C.** J. Crosfield & Sons, Ltd., Bank Quay, Warrington. (Warrington 800.)

DOUBLES.

Haines, J., & Hawley, F. G. Anglo-Persian Oil Co., Britannic House, Finsbury Circus, London, E.C.2. (National 1212.)	*v*	**Giltrow, L., & Hammond, G. F.** Williams (Hounslow), Ltd., Hounslow. (Hounslow 2929.) or **Pennington, R. C. & George, R.** J. Crosfield & Sons, Ltd., Bank Quay, Warrington. (Warrington 800.)

ALTHOUGH China possesses enormous pine forests neither gum spirits of turpentine nor wood turpentine are produced domestically. Mineral spirit is utilised in considerable quantities in place of turpentine, either alone or mixed with turpentine. Total imports of turpentine and mineral spirits into China advanced from 232,584 gal. to 446,475 gal. for 1931. Chief countries of origin for the 1931 imports were: Netherland India 401,607 gal., United States 25,653 gal., and British Malaya 6,920 gal.

Motor Spirit from Low Temperature Carbonisation

A Study of Refining Procedure

THE refining of motor spirits obtained by the low-temperature carbonisation of coal, or by the hydrogenation of coal or low-temperature tar, was dealt with by Dr. A. B. Manning, in the course of a paper presented at the World Petroleum Congress, on July 24. Dr. Manning pointed out that spirits from the low-temperature carbonisation of coal have been successfully refined by treatment with 80 per cent. sulphuric acid; by treatment of the spirits with anhydrous $AlCl_3$ a stable light spirit (50 per cent), a middle fraction of boiling range 170--360° C. (20 per cent.) and a lubricating fraction (6—10 per cent) have been produced; whilst spirits obtained by hydrogenating low-temperature tar or coal have been successfully refined by acid treatment, preferably using 70 per cent sulphuric acid.

On carbonising a bituminous coal at about 600° C., 3 to 3.5 gal. of light spirit boiling to 170° C. are obtained. About two-thirds of this spirit is recovered from the gas, either by scrubbing with oil or by means of a solid adsorbent, whilst the remainder is constituted by the lightest boiling fraction of the tar. The following are typical analyses of the crude spirits after these have been freed from tar acids and bases by washing with dilute caustic soda and dilute (10 per cent.) sulphuric acid :—

Type of Coal.	Gas Spirits. (Per cent. by weight.) Unsaturated Hydrocarbons.	Gas Spirits. (Per cent. by weight.) Aromatic Hydrocarbons.	Gas Spirits. (Per cent. by weight.) Naphthenes and Paraffins.	Tar Spirits. Per (cent. by weight.) Unsaturated Hydrocarbons.	Tar Spirits. Per (cent. by weight.) Aromatic Hydrocarbons.	Tar Spirits. Per (cent. by weight.) Naphthenes and Paraffins.
"Shafton" (weakly caking) ..	46.0	16.4	37.6	41.8	36.5	21.7
"Dalton Main" (medium caking)	32.1	31.1	36.8	27.3	46.6	26.1
"Mitchell Main" (strongly caking)	20.0	37.0	43.0	19.3	59.8	20.9

The crude spirits contain considerable amounts of unsaturated compounds. A small proportion of these are unstable, especially on exposure to light and air, and more or less rapidly oxidise and/or polymerise to form "gum." The problem in refining such spirits is to remove the unstable, gum-forming hydrocarbons without appreciably affecting the more stable unsaturated hydrocarbons.

Sulphuric Acid as a Refining Agent

Attempts to use small amounts of concentrated sulphuric acid as a refining agent showed that the action of the acid was too drastic, leading to overheating, to the oxidation of the unsaturated hydrocarbons with the evolution of sulphur dioxide, to the formation of unstable sulphuric acid esters, which were retained in the washed spirit, and to the formation of persistent emulsions on subsequent washing with water. Much better results were obtained by the use of less concentrated acid, and a series of experiments with acids of varying concentration showed that the optimum value was in the neighbourhood of 80 per cent.; it varied slightly, however, with different crude spirits. With some spirits washing with 80 per cent. acid produced too great a rise in temperature, leading to undesirable side reactions, such as oxidation or the formation of acid esters as mentioned above; in such cases a preliminary wash with less concentrated acid, *e.g.*, 70 per cent. was necessary.

The efficiency of refining was at first judged only by the appearance and odour of the product, especially after a short period of storage. The various oxidation tests for "potential gum" which have been proposed for benzoles or for petroleum spirits appear to be too drastic with low-temperature carbonisation spirits; the amounts of gum produced in these spirits by oxidation under the test conditions are very much higher than those formed, for example, after twelve months' storage. An attempt is being made to find a modified method of accelerating gum formation such that the amount produced during the test period is comparable with that produced after six or twelve months' storage.

The procedure finally adopted for refining the crude spirit on an intermediate scale (*e.g.*, in 20 gal. batches) was (1) wash with 5 per cent. (by volume) of 5 per cent. caustic soda solution; (2) wash with 5 per cent. (by volume) of 80 per cent. sulphuric acid (sp. gr. 1.73); (3) wash with water, avoiding agitation; (4) wash with 10 per cent. (by volume) of 5 per cent. caustic soda solution; (5) wash with water; and (6) redistil, using open steam when the temperature had passed 100° C. If closed steam were used throughout the distillation, *i.e.*, up to the final temperature of 170° C., some decomposition occurred with the liberation of sulphur dioxide, presumably from small amounts of sulphuric acid esters which had been formed during acid washing, and the resulting distillate was unstable, possessing an unpleasant odour and becoming coloured after a few days' storage. The losses on refining were 10-15 per cent. The change in composition on refining (for spirit from Shafton coal) is illustrated by the following results :—

	Unsaturated Hydrocarbons. Per cent. by wt.	Aromatic Hydrocarbons. Per cent. by wt.	Paraffins and Naphthenes. Per cent. by wt.
Crude gas spirit ..	46.0	16.4	37.6
Refined gas spirit ..	41.9	16.2	41.9
Crude tar spirit ..	41.8	36.5	21.7
Refined tar spirit ..	33.0	42.5	24.5

Similar results were obtained with other spirits. The main effect of refining was to remove 8—12 per cent. of the unsaturated hydrocarbons only, the ratio of aromatic to paraffin and naphthene hydrocarbons remaining practically unchanged.

Deterioration Tests

Some of the refined spirits were submitted to tests to determine their behaviour on storage. The spirits were stored in glass bottles (not completely filled) and kept in a closed cupboard. At suitable intervals determinations were made of (a) composition, (b) octane number, (c) gum content, and (d) peroxide content, of the spirits. The formation of gum and peroxide on storage had no appreciable effect on the composition of any of the spirits, *i.e.*, on the content of unsaturated, aromatic, naphthene and paraffin hydrocarbons, which remained constant, within the experimental error, over the period of duration of the tests.

Freshly refined spirits have such high anti-knock values that although these do fall off with storage, the values at the end of six months are still equivalent to or even better than those of the best commercial motor spirits. From this point of view, therefore, deterioration is not serious. It is a little difficult to decide at what point gum formation becomes serious. The value obtained for the gum content depends on the method used for its determination. Taking this into consideration and fixing the maximum permissible value tentatively at 25 mg./100 ml., it may be concluded that the three spirits, the data relating to which are tabulated above, can safely be stored for six months, three to four months and one month respectively. In the first two cases refining could be said to be satisfactory, but not in the last case. The peroxides formed on storage could be destroyed by shaking the spirit with a little dilute caustic soda solution. The octane number of the spirit was raised by this treatment, although not to the original value. The gum content of the stored spirit was not appreciably affected by the alkali treatment.

Action of Aluminium Chloride

No complete study has been made of other methods of refining; the preliminary experiments which have been carried out on certain other methods have been rather disappointing in their results. Not all the suggested methods, however, have been tried; for example, it is claimed that the Instill process will successfully refine low-temperature carbonisation spirit ("Gas World, Coking Section, 1931, *94*, 26), but no experiments theron have been carried out at the Fuel Research Station. The possibility of using silica gel as a

refining agent has been suggested but has not yet been tried.

The action of anhydrous aluminium chloride on the spirit has been studied, from the point of view not only of refining the spirit but also of producing lubricating oils by the condensation of the unsaturated hydrocarbons therein. By refluxing the spirit, or preferably by heating it in a closed vessel to about 80° C., with 7-10 per cent. of anhydrous $AlCl_3$ for twelve hours, the greater part of the unsaturated constituents were converted into higher boiling oils.

The light spirit, which represents about 50 per cent. of the original spirit, was water-white, sweet-smelling, and perfectly stable on storage. In addition the process yields about 20 per cent. of stable oils boiling between 170° C. and 360° C., and 6-10 per cent. of a heavy, viscous fraction, which constitutes a lubricating oil of good quality. Attempts to refine the original crude spirit by treatment with small quantities of anhydrous aluminium chloride failed; apparently the reagent reacts with the more stable unsaturated hyrdocarbons almost as readily as with the gum-forming unsaturated hydrocarbons and so is unable to remove the latter selectively.

Hydrogenated Low Temperature Tar

By heating low-temperature tar at 450-500° C. with hydrogen under 200 atm. pressure, in the presence of a molybdenum catalyst, a considerable conversion of the tar into light spirit is effected. Thus in one experiment the yield of spirit boiling below 230° C. (two-thirds of which boiled below 170° C.) amounted to 70 per cent. by volume of the tar; by recirculation of the heavier oil a 100 per cent. conversion on a volume basis) has been obtained. The refining of this light oil, which is considerably more stable than the low-temperature carbonisation spirits, presents a comparatively simple problem.

Treatment with 5 per cent. by volume of 70 per cent. sulphuric acid, preferably in two stages, using 2½ per cent. in each ,was sufficient to give a stable,water-white, sweet-smelling product. The acid wash was preceded by an alkali wash to remove tar acids, and was followed by all ali and water washes as in usual practice. The washing losses were about 6 per cent., half of which represents tar acids removed in the first alkali wash and the remainder unsaturated hydrocarbons removed during acid washing. Such a refined spirit after twelve months' storage had a gum content of only 6-8 mg./100 mls. A considerable degree of refining could be effected by rehydrogenating the spirit itself, but the product was not as stable as the acid-washed spirit.

Spirits from Hydrogenation of Coal

The spirits obtained in the original hydrogenation process, in which the puvlerised coal, mixed with a suitable vehicle and about 5 per cent. of luxmasse, was heated to 450-500° C. with hydrogen under 200 atm. pressure, contained about 10 per cent. of unsaturated hydrocarbons and rapidly became discoloured on storage. The yield of spirit boiling below 230° was 30-40 gal. per ton of coal. It could be refined successfully by the method used for low-temperature carbonisation spirits, *i.e.*, with 80 per cent. sulphuric acid as the refining agent. More recent developments in the hydrogenation of coal, in which the process may be carried out in two or more stages, in each of which a suitable catalyst is employed, gives much higher yields (*e.g.*, 125 gal. or more per ton of coal) of a more stable spirit containing only about 5 per cent. of unsaturated hydrocarbons. This spirit still needs refining, however, which can satisfactorily effected by treatment with about 1 per cent. of concentrated sulphuric acid, or by the method which was found suitable for the spirits from hydrogenated low-temperature tar, *i.e.*, by washing with 70 per cent. sulphuric acid.

The CHAIRMAN (Dr. Gustav Egloff, United States) mentioned that during the past three or four years the refiners on the Californian section of the Pacific Coast have been modifying the sulphur content of their cracked spirit so that instead of the one-tenth of 1 per cent. usually called for by the specifications the figure has been 25/100ths of 1 per cent. on the average. As a matter of fact some motor fuel containing 5/10ths of 1 per cent. of sulphur had been marketed without any complaint. At the present time on the Pacific Coast 10 million gal. of cracked spirit per day containing 25/100ths of 1 per cent. of sulphur were being produced. When one large company first put this relatively high sulphur content spirit on the market the salesmen said they would not be able to sell it but they were promptly told that someone else would be found who could. Actually, however, the salesmen found no difficulty in selling this petrol containing more than the usual 1/10th of 1 per cent. As a result there had been a saving of millions of dollars yearly in production costs. At the same time, an enormous amount of research was still going on in the endeavour to market, economically, motor fuels with a very low sulphur content. The material most commonly used to reduce the sulphur was sulphuric acid, and there was no other method which was used to a greater extent at the present time in order to reduce the sulphur to meet the usual stringent specifications.

The Vapour Phase Clay Process

LIEUT.-COL. S. J. AULD (Great Britain) said there is at the present time a tendency in some quarters to replace refining by the use of inhibitors, and he regarded that as a form of cheating. The use of inhibitors might be satisfactory if the spirit was to be sold and used immediately, but the problem of storage must always be considered. In some cases it would be necessary to store for many months and then the results obtained by the use of inhibitors were not likely to be so satisfactory. As regard refining, although new methods were in the offing which might ultimately be found to be extremely useful, at the present time the field was definitely divided between the use of sulphuric acid and clays. Personally, he could not understand why sulphuric acid, with its attendant miseries, shoud be regarded in the United States—which had always led in these matters—as the better method. At any rate, it was used to a much greater extent there than the vapour phase clay method, and he was inclined to think this was due to the fact that the latter is more or less a proprietary process and not a free one like the sulphuric acid process; also the greater use of the sulphuric acid process in America is due to the patent position as it affects the vapour phase clay process.

There were, however, several advantages in the clay process which did not apply to the sulphuric acid process although, necessarily, there were certain disadvantages. It was essential, of course, to get the right kind of clay which must be neither too active nor the reverse, but apart from this there were one or two disadvantages which, at the moment, it was not easy to see a way out of. One was the necessity for re-running if the unsaturated gases were to be of any use and time was not to be spent on refining the gases by means of the clay. Therefore, it was necessary to get rid of the gas first of all by re-running, and the fractionation from the first run of the crack stills must be as complete as possible in order to get everything into the petrol ultimately, and at the same time not to overload the clay towers by passing through them heavier material than was actually wanted in the ultimate spirit.

A Better All-Round Gasoline

DR. EGLOFF said it was never felt that in the United States they were doing anything in the way of "cheating," in what they were doing in the motor spirit industry. As a matter of fact, it was felt that the public was now getting a better product than was formerly the case, when nothing but drastic refining to meet the specifications was resorted to. Moreover, after all it must be remembered that those concerned with the industry were in it for the purpose of making money. There was little doubt in his view that the old specifications were a dead hand on the industry. The era of gasoline containing only 1/10th of 1 per cent. of sulphur began about 16 years ago, when the technologists had knowledge only of gasoline containing less than 1/10th of 1 per cent. of sulphur. The thing that really mattered was how the spirit performed in practice and experience had shown that instead of "cheating," the industry was really giving the public a better spirit for general purposes. It was possible by the use of inhibitors to make motor spirit stable for at least six months and even for a year of storage, and adopting the methods he had referred meant a saving of 1/10th cent. per gallon in production costs which, having regard to the large quantity produced, amounted to a considerable sum of money. In the case of eight plants with which he was concerned, acid treatment had been eliminated and the use of inhibitors adopted, whilst in the case of other plants the acid treatment had been cut down by one-half. The goal was to eliminate, or to modify as far as possible, the depreciation of the motor spirit and he contended that a better all-round gasoline was the result.

News from the Allied Industries

Rubber

SUGGESTIONS FOR RUBBER RESTRICTION have been received by the Dutch East Indies Government from British rubber interests. These suggestions were formerly considered by the Government to be impracticable owing to the impossibility of controlling native plantings.

Sugar

THE GENERAL OPINION EXPRESSED at a recent meeting of the Central Committee of the Nivas, the Dutch East Indies Sugar Association, which was called to consider the sugar planting plans for 1934, was that there should be no planting at all in view of the large stocks. Sugar stocks in Java on July 31 amounted to 2,750,000 tons, compared with 2,398,000 tons a year before. This year's planting was severely restricted and the crop to be harvested next April is not expected to exceed 500,000 tons.

Non-Ferrous Metals

THE QUARTERLY REPORT of the International Nickel Company of Canada provides an amazing example of recovery possibilities. A net profit of $1,943,000 is recorded, against a loss of $80,000 for the previous quarter. Net operating income amounted to $2,941,092, this being more than three-and-a-half times the total reported for the first quarter. For the first six months of the year, the net profit, after the usual deductions, but not including the exchange adjustments credit referred to above, was $1,862,888, which is equivalent to six cents per share on the common stock, after allowing for the preferred dividend. This compares with a net loss of $93,255 for the first six months of 1932. Earned surplus as at June 30 last was $15,808,961, compared with $14,261,927 at the end of the first quarter.

Fertilisers

IT IS STATED THAT AN AGREEMENT negotiated recently between Chilian and Belgian producers of nitrate, of which certain details are still outstanding, will shortly be concluded. This agreement refers only to the Belgian market, and does not affect the position of Belgian producers in relation to other European countries. It is understood that the agreement provides in particular for a fixed relationship between the prices of Chilian nitrate and synthetic nitrates on the Belgian market.

Artificial Silk

AS A RESULT OF THE PROTEST made by the board of the Branston Artificial Silk Co., the private sale of the company's properties to Courtaulds, Ltd., is not to be proceeded with. The Alliance Assurance Co., however, which holds a charge on the assets, insists upon repayment of its loan before September 18, otherwise they will sell the properties on that day by auction to the highest bidder. This concession is of considerable importance to the Branston company, as shareholders now have as many weeks as they formerly had days in which to save their property. Whether or not this will be accomplished depends entirely upon the response made to the directors' offer of notes. Those notes will run for a period of five years, and will carry interest at the rate of 5 per cent. per annum. They will be repayable on December 31, 1938, at £22 10s. each, representing a premium of £2 10s. Shareholders have had a disappointing experience, as no dividend has been paid on either class of capital since the registration of the company in 1927, while the debit balance at profit and loss account now stands at £519,419.

IT IS ESTIMATED THAT world rayon output during the first half of the current year amounted to 128,590 metric tons, against 108,305 metric tons in the first half of 1932. Increases in output are recorded in every producing country, with the exception of Belgium, Britain and Poland. The low level of British production when compared with last year is due to reduced output in the first quarter of the year. Japan has now secured second place in the list of world producers with a total of 18,335 metric tons, an increase of 5,470 metric tons over her output from January to June, 1932. Increases are also recorded by Germany, the United States, and France.

Glass

PILKINGTON BROS., LTD., St. Helens, and Kirk Sandall, Doncaster, who were among the first to reduce working hours from 12 to 8 per day, have now reduced the working hours at Kirk Sandall from 48 to 42 per week without reducing wages. By this means they hope to increase employment in the factory, which at present amounts to about 1,200 hands. The general manager at Kirk Sandall stated that there was practically no unemployment in the glass industry, and although they had suffered from the depression they had recently taken on more workers. This arrangement will continue for an experimental period of six months.

Iron and Steel

THE TATA IRON AND STEEL CO., LTD., India, has appointed as its chief engineer Mr. H. C. Loving, formerly chief engineer at Sheffield of the English Steel Corporation.

THERE HAS BEEN SOME DECLINE in the volume of business in the iron and steel markets due to the seasonal influences. The official report of the London Iron and Steel Exchange, however, points out that the position is sound, since most of the British works have a good tonnage of orders in hand and can afford to face with equanimity the decline in business which usually takes place during the holiday season. The demand for pig-iron has been well maintained, and some of the big consumers have covered their requirements until the end of the year. For the time being transactions are principally confined to small parcels, but it is anticipated that when the autumn demand makes itself felt there will be an important expansion in business.

Calico Printing

ACCOUNTS OF THE CALICO PRINTERS' ASSOCIATION for the year ended June 30 show that the recovery experienced in 1931-32 has not been fully maintained. The net profit earned amounts to £123,926, which compares with £157,458 for the previous year. The profit is struck after providing £366,790, against £359,970, for maintenance, depreciation, repairs, renewals, and upkeep, and the usual £128,000 for debenture interest. An interim dividend for the December half-year amounting to £75,402 was paid on the 5 per cent. preference stock. The directors have decided to pay the final dividend on this stock, but this necessitates an appropriation from reserve. No distribution is possible on the ordinary stock; the last dividend paid was in respect of the year 1928-29. The Calico Printers' Association has an issued capital of a little over £5,000,000, of which £3,000,000 is in preference stock and £2,000,000 in ordinary stock. There is also outstanding £3,200,000 of 4 per cent. perpetual debenture stock. After the deduction just made the company will have a general reserve of £800,000 and a capital reserve of similar amount.

Chemical Notes from Overseas

New Enterprise in Russia

THE Soviet Government is showing increased interest in the exploitation of rare elements, and titanium ores are being given special attention. Enormous deposits of titanium-magnetic-iron ores in the Urals have not been utilised. The trust "Lakokraska" is arranging for the construction of a new plant for the production of titanium white. Experiments are also being conducted regarding the smelting of titanium-magnetic-iron ores with coke in blast furnaces designed to improve the separation of the vanadium-containing raw iron from the titanium-containing slag with sodium chloride.

Exports from the United States

EXPORTS of formaldehyde, citrate of lime, and miscellaneous synthetic organic chemicals from the United States during the first five months of 1933, were all larger than in the corresponding period of 1932, but exports of acetone and carbon bisulphide were less. Figures for the first five months of 1933 were: Formaldehyde, 1,436,000 lb.; citrate of lime, 3,767,000 lb.; acetone, 1,265,000 lb.; carbon bisulphide, 1,072,000 lb.; miscellaneous synthetic organic chemicals, 2,700,000 lb.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

THE following market report is based on information supplied by the British manufacturers concerned, and unless otherwise qualified the figures quoted apply to fair quantities, net and naked at makers' works. Where no locality is indicated, the prices are general for the United Kingdom. Particulars of the London chemical market are specially supplied to THE CHEMICAL AGE by R. W. Greeff and Co., Ltd., and Chas. Page and Co., Ltd., and those of the Scottish chemical market by Chas. Tennant and Co., Ltd.

THE London chemical market continues to receive a fair average of inquiry, whilst the volume of actual business placed is satisfactory having regard to the seasonal influences. Prices for practically all products are unchanged, with firm conditions. Holidays in a number of industrial districts in the Lancashire area continue to have a restrictive influence on the volume of business in the Manchester chemical market, but the position in this respect during the past week has been less pronounced than it was in the earlier part of the month. A slight increase in the number of sales has been reported; brought forward buying of any consequence is still relatively small. There has been a slight falling back in the Scottish heavy chemical market, with a tendency to price cutting.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £38 5s. to £40 5s.; pure 80% £39 5s.; tech., 40%, £20 5s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. LONDON: Tech., 80%, £38 5s. to £40 5s.; pure 80%, £39 5s. to £41 5s.; tech., 40%, £20 5s. to £22 5s.; tech., 60%, £29 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech. 80%, £38 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—SCOTLAND: Granulated commercial, £26 10s. per ton; B.P. crystals, £35 10s.; B.P. powder, £36 10s. in 1-cwt. bags d/d free Great Britain in 1-ton lots upwards.

ACID CHROMIC.—10½d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—LONDON: 9¼d. per lb.; less 5%. MANCHESTER: 9¼d. to 9¾d.

ACID, CRESYLIC.—97/99%, 1s. 1d. to 1s. 7d. per gal.; 98/100%. 1s. 5d. to 2s.

ACID, FORMIC.—LONDON: £47 10s. per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £48; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works, according to district and quality. SCOTLAND: 80°, £23 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 7s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £49 to £52 ex store. MANCHESTER: £48 to £54 ex store.

ACID, SULPHURIC.—Average prices f.o.r. British makers' works, with slight variations owing to local considerations; 140° Tw. crude acid, £3 per ton; 168° Tw. arsenical £5 10s.; 168° Tw. non-arsenical, £6 15s. SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—LONDON: 11d. per lb. SCOTLAND: B.P. crystals, 11d., carriage paid. MANCHESTER: 11¾d.

ALUM.—SCOTLAND: Lump potash, £9 per ton ex store.

ALUMINA SULPHATE.—LONDON. £8 5s. to £9 10s. per ton. SCOTLAND: £8 to £8 10s. ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £32 per ton; powdered, £34, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £19 to £20. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £26 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden 6½d. to 1s. 1½d. per lb.; crimson, 1s. 3d. to 1s. 5d. per lb., according to quality.

ARSENIC.—LONDON: £17 c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £23 at mines.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—£11 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot 35/37% £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 15s. in 5/6 cwt. casks.

BORAX, COMMERCIAL.—Granulated, £15 10s. per ton; powder, £17 packed in 1-cwt. bags, carriage paid any station Great Britain. Prices are for 1-ton lots and upwards.

CADMIUM SULPHIDE.—2s. 9d. to 3s. 1d.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums.

CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.

CARBON BLACK.—3½d. to 4¾d. per lb., ex wharf.

CARBON TETRACHLORIDE.—£41 to £46 per ton, drums extra.

CHROMIUM OXIDE.—10½d. per lb., according to quantity d/d U.K. Green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 3½d. per lb. Liquor, £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—LONDON: £4 per cwt.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £28 per ton. SCOTLAND: 40%, £28 ex store.

LAMPBLACK.—£45 to £48 per ton.

LEAD ACETATE.—LONDON: White, £34 per ton; brown, £1 per ton less. SCOTLAND: White crystals, £33 to £35; brown, £1 per ton less. MANCHESTER: White, £32; brown, £30.

LEAD NITRATE.—£28 per ton.

LEAD, RED.—SCOTLAND: £25 10s. to £28 per ton d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid.

LITHOPONE.—30%, £17 10s. to £18 per ton.

MAGNESITE.—SCOTLAND: Ground Calcined £9 per ton ex store.

METHYLATED SPIRIT.—61 O.P. Industrial 1s. 8d. to 2s. 3d. per gal. Pyridinised Industrial, 1s. 10d. to 2s. 5d. Mineralised, 2s. 9d. to 3s. 3d. 64 O.P. 1d. extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£49 per ton d/d.

NICKEL SULPHATE.—£49 per ton d/d.

PHENOL.—9d. to 10d. per lb. nominal.

POTASH, CAUSTIC.—LONDON: £42; MANCHESTER: £41.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. net d/d U.K. Discount according to quantity. Ground 5¾d. LONDON: 5d. per lb. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100% powder, £37. MANCHESTER: £38.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM NITRATE.—SCOTLAND: Refined Granulated £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¼d. per lb. SCOTLAND: B.P. crystals, 8¼d. MANCHESTER: Commercial, 8¼d. B.P. 8¾d.

POTASSIUM PRUSSIATE.—LONDON: 8¼d. to 8¾d. per lb. SCOTLAND: Yellow spot material, 8¼d. ex store. MANCHESTER: Yellow, 8¾d.

SALAMMONIAC.—First lump spot, £42 17s. 6d. per ton d/d in barrels.

SODA ASH.—58% spot, £5 17s. 6d. per ton f.o.r. in bags, special terms for contracts.

SODA, CAUSTIC.—Solid 76/77° spot, £14 5s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 15s. in casks, Solid 76/77%, £14 10s. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 10s. contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£22 per ton. LONDON: £23.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 10s. ex quay or station. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous, 5d. per lb. LONDON: 4d. per lb. with discounts for quantities. SCOTLAND: 4d. delivered buyer's premises with concession for contracts. MANCHESTER: 4d. less 1 to 3½% contracts, 4d. spot lots.

SODIUM BISULPHITE POWDER.—60/62%, £16 10s. per ton d/d 1-cwt. iron drums for home trade.

SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—£32 per ton.

SODIUM CHROMATE.—3¾d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea

crystals, £15 ex station, 4-ton lots. MANCHESTER: Commercial, £9 5s.; photographic, £15.

SODIUM NITRITE.—LONDON: Spot, £18 to £20 per ton d/d station in drums.

SODIUM PERBORATE.—LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£12 10s. per ton.

SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5⅔d. ex store. MANCHESTER: 4⅔d. to 5⅔d.

SODIUM SILICATE.—140° Tw. Spot £8 5s. per ton d/d station, returnable drums.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d. SCOTLAND: English material £3 15s.

SODIUM SULPHATE (SALT CAKE).—Unground Spot, £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 5s.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d. d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.

SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot, £9 10s. d/d station in bags.

SULPHATE OF COPPER.—MANCHESTER: £16 10s. to £17 per ton f.o.b.

SULPHUR.—£11 10s. per ton. SCOTLAND: Flowers, £11; roll, £10 10s.; rock, £9; ground American, £10 ex store.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.

SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.

VERMILION.—Pale or deep, 4s. 3d. to 4s. 5d. per lb.

ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

ZINC SULPHATE.—LONDON AND SCOTLAND: £12 per ton.

ZINC SULPHIDE.—11d. to 1s. per lb.

Pharmaceutical and Fine Chemicals

CADMIUM IODIDE.—14s. 6d. per lb.

IRON AMMON. CITRATE.—B.P., 1s. 9d. per lb.; green, 2s. 5d. per lb.

IRON QUININE CITRATE.—9¾d. to 1s. 0½d. per oz.

LINALOL (ex Shui oil).—5s. 9d. per lb.

LINALYL ACETATE.—Ex Bois de Rose, 7s. 6d. per lb.; ex Shui oil, 6s. 6d.

MENTHOL.—A.B.R. recryst., B.P., 15s. per lb.; synthetic detached crystals, 8s. 6d. to 10s. 6d. per lb.

PHENACETIN.—4s. to 4s. 6d. per lb.

Intermediates and Dyes

IN the following list of intermediates delivered prices include packages except where otherwise stated:—

ACID, BENZOIC, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100% d/d buyer's works.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.

BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.

p-CRESOL 34-5° C.—1s. 9d. per lb. in ton lots.

m-CRESOL 98/100%.—2s. 3d. per lb. in ton lots.

DICHLORANILINE.—2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8d. per lb.

DINITROTOLUENE.—48/50° C., 8d. per lb.; 66/68° C. 8¾d. per lb.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—Spot, £78 15s. per ton in paper bags; £79 15s. in casks, in 1-ton lots.

α-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.

o-NITRANILINE.—5s. 10d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 4½d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE.—9d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—Spot, 9½d. per lb., drums extra, d/d buyer's works.

p-TOLUIDINE.—Spot, 1s. 11d. per lb., d/d buyer's works.

m-XYLIDINE ACETATE.—3s. 4d. per lb.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 9d. to 10d. per lb.; crude, 60's, 2s. 5d. to 2s. 6d. per gal.; 2% water 3s. 0¾d. MANCHESTER: Crystals, 9d. per lb.; crude, 2s. 7d. per gal. SCOTLAND: 60's, 1s. 7d. to 1s. 8d.

ACID, CRESYLIC.—99/100%, 11d. to 1s. 8d. per gal.; pale, 98%, 1s. 4d. to 1s. 5d.; pale 95%, 11d. to 11½d.; dark, 10d., all according to specification; refined, 1s. 8d. to 1s. 9d. LONDON: 98/100%, 1s. 3d.; dark, 95/97%, 11d. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; 97/99%, 1s. to 1s. 1d.; dark, 97/99%, 11d. to 1s.; high boiling acid, 2s. 6d. to 3s.

ANTHRACENE OIL.—Strained, 4½d. per gal.

BENZOL.—At works, crude, 9d. to 9½d. per gal.; standard motor 1s. 4d. to 1s. 4½d.; 90%, 1s. 5d. to 1s. 6d.; pure, 1s. 7½d. to 1s. 8d. LONDON: Motor, 1s. 6½d. SCOTLAND: Motor, 1s. 6½d. to 1s. 7½d.; 90%, 2s. 0½d. to 2s. 1½d.

CREOSOTE.—B.S.I. Specification standard, 3d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 3d. to 3½d. f.o.r. North; 4d. to 4½d. London. MANCHESTER: 2⅔d. to 3¾d. SCOTLAND: Specification oils, 3½d. to 4d.; washed oil, 3½d. to 4d.; light, 3d. to 3½d.; heavy, 4½d. to 5d.

NAPHTHA.—Solvent, 90/160%, 1s. 4d. to 1s. 5d. per gal.; 95/160%, 1s. 7d.; 90/190%, 9d. to 1s. 1d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.

NAPHTHALENE.—Crude, Hot-Pressed, £6 1s. 3d. per ton. Flaked, £10 per ton. Purified crystals, £9 10s. per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 70s. to 75s.

PITCH.—Medium soft, £3 17s. 6d. to £4 per ton. MANCHESTER: £4 f.o.b. LONDON: £3 15s. f.o.b. East Coast port for next season's shipment.

PYRIDINE.—90/140, 4s. to 4s. 6d. per gal.; 90/180, 2s. to 2s. 6d. SCOTLAND: 90/160% 4s. to 5s.; 90/220%, 3s. to 4s.

REFINED COAL TAR.—SCOTLAND: 4d. per gal.

TOLUOL.—90%, 2s. 2d. to 2s. 3d.; pure, 2s. 7d. to 2s. 8d.

XYLOL.—Commercial, 2s. to 2s. 1d. per gal.; pure, 2s. 3d. to 2s. 4d.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—The price of this product for delivery in 6-ton lots to consumer's nearest station during August, September and October is £6 15s. per ton. The export price continues steady at £6 6s. 3d. per ton for August and £6 7s. 6d. per ton for September shipment f.o.b. U.K. ports in single bags.

NITRO-CHALK.—The price of this product for delivery up to June, 1934, in 6-ton lots carriage paid to farmer's nearest station remains at £7 5s. per ton.

BRITISH NITRATE OF SODA.—The price of this fertiliser, which has recently been quoted at £7 5s., is announced as follows for delivery in the months stated: August/October, £7 8s. 6d.; November, £7 11s.; December, £7 13s. 6d.; January, £7 16s.; February/ June, £7 18s. 6d. These prices are the same as those now ruling for the Chilean product.

CALCIUM CYANAMIDE.—The prices for calcium cyanamide 20.6% nitrogen, powdered and oiled, packed in paper lined bags of 2 cwt. gross weight for net, will be as follows: September/October delivery, £7 per ton; November, £7 1s. per ton; December, £7 2s. per ton; January, £7 3s. per ton; February, £7 4s. per ton; March/June, £7 5s. per ton; carriage paid to any railway station in Great Britain in lots of 4 tons and over. Cyanamide is sold on the basis of 20.6% nitrogen with no charge for excess, but with an allowance for deficiency, if any, in analysis as follows: 1s. per ton if the percentage of nitrogen is under 20.6% but not less than 20.5%; 2s. per ton if the percentage of nitrogen is under 20.5% but not less than 20.25%; and 4s. per ton if the percentage of nitrogen is under 20.25% but not less than 20.00%.

CHILEAN NITRATE OF SODA.—Prices have been announced as follows for delivery in 6 ton lots, carriage paid to buyer's station, gross for net:—July/October, £7 8s. 6d. per ton; November, £7 11s. 3d. per ton; December, £7 14s. per ton; January, £7 16s. 9d. per ton; February/June, £7 19s. 6d. per ton.

CONCENTRATED COMPLETE FERTILISERS.—The prices of these products for August delivery range from £10 9s. 6d. to £11 per ton, according to percentage of constituents.

Latest Oil Prices

LONDON, August 23.—LINSEED OIL was lower. Spot, small quantities, £23 5s.; Sept., £20 5s.; Sept.-Dec., £20 7s. 6d.; Jan.-April, £21 per ton, naked. RAPE OIL was steady, unchanged. Crude extracted, £28 10s.; technical refined, £30 per ton, naked, ex wharf. COTTON OIL was quiet. Egyptian crude, £21; refined common edible, £24; and deodorised, £26 per ton, naked, ex mill. TURPENTINE was steady. American, spot, 48s. 9d. per cwt.

HULL.—LINSEED OIL.—Spot quoted £21 2s. 6d. per ton; Aug., £20 12s. 6d.; Sept.-Dec., £20 15s.; Jan.-April, £21 2s. 6d. COTTON OIL.—Egyptian, crude, spot, £20 10s.; edible, refined, spot, £23; technical, spot, £23; deodorised, £25, naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £17 5s., naked. GROUNDNUT OIL.—Extracted, spot, £23 10s.; deodorised, £27 10s. RAPE OIL.—Extracted, spot, £27 10s.; refined, £29. SOYA OIL.—Extracted, spot, £21; deodorised, £24 per ton. COD OIL, 21s. per cwt., nominal. CASTOR OIL.—Pharmaceutical, spot, 38s.; first, 33s.; second, 30s. per cwt. TURPENTINE.—American, spot, 51s. 3d. per cwt.

Inventions in the Chemical Industry

Specifications Accepted and Applications for Patents

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Accepted with Dates of Application

PREPARATION OF CATALYTIC MATERIALS AND OF CARRIERS THEREFOR. H. Spence, I. P. Llewellyn, and P. Spence and Sons, Ltd. Oct. 31, 1931. 386,780.

PRODUCTION OF ORGANIC AMINES.—G. T. Morgan and D. D. Pratt. Dec. 11, 1931. 396,760.

MANUFACTURE OF CONDENSATION PRODUCTS.—H. Dreyfus. Jan. 5, 1932. 396,761.

METHODS OF AND APPARATUS FOR ASSISTING CHEMICAL REACTION BETWEEN GASES AND LIQUIDS.—P. Letourneur. Feb. 11, 1931. 396,744.

PRODUCTION OF MIXED FERTILISERS.—Ruhrchemie Akt.-Ges. March 9, 1931. 396,729.

TREATMENT OF NON-FERROUS ALLOYS TO PROTECT THEM AGAINST CORROSIO.—H. C. Hall. Feb. 4, 1932. 396,746.

MANUFACTURE OF ALKALI METAL CHLORATES.—C. Carter and Imperial Chemical Industries, Ltd. Feb. 4, 1932. 396,701.

MANUFACTURE OF SAFETY GLASS.—C. W. Bonniksen. Feb. 6, 1932. 396,713.

SEPARATION OF UNSAPONIFIABLE MATTER FROM OILS, FATS, WAXES, MIXTURES CONTAINING FATTY ACIDS, AND CRUDE SOAPS.—J. Y. Johnson (I. G. Farbenindustrie). Feb. 8, 1932. 396,769.

MANUFACTURE AND PRODUCTION OF COBALT NITROSOCARBONYL AND/OR COBALT NITROSYL.—J. Y. Johnson (I. G. Farbenindustrie.) Feb. 8, 1932. 396,717.

SEPARATION OR PURIFICATION OF CHLORINATED DERIVATIVES OF PHTHALIC ACID.—E. G. Beckett, C. Shaw, W. E. Stephen, G. C. Semple, R. F. Thomson, and Imperial Chemical Industries, Ltd. Feb. 9, 1932. 396,735.

MANUFACTURE OF ALIPHATIC ACIDS, ANHYDIDES AND KETONES.—H. Dreyfus. Feb. 9, 1932. 396,770.

PROCESS FOR CONSERVING TECHNICAL AND PHARMACEUTICAL PREPARATIONS AND OTHER SUBSTANCES LIABLE TO ATTACK BY MICRO-ORGANISMS.—A. Carpmael (I. G. Farbenindustrie.) Feb. 9, 1932. 396,737.

MANUFACTURE OF DERIVATIVES OF UNSATURATED FATTY ALCOHOLS. Deutsche Hdyrierwerke Akt.-Ges. Feb. 11, 1931. 396,774.

PRODUCTION OF ETHERS OF CELLULOSE ESTERS.—H. Dreyfus. Feb. 12, 1932. 396,796.

MANUFACTURE OF WAXED PAPERS.—C. A. Chester and Raymakers Syndicate, Ltd. Feb. 13, 1932. 396,810.

ELECTROLYTIC PRODUCTION OF MAGNESIUM.—Johnson, Matthey and Co., Ltd. Feb. 19, 1931. 396,827.

METHOD FOR THE INTRODUCTION OF FOAM-PRODUCING CHEMICALS INTO A STREAM OF WATER AND APPARATUS THEREFOR.—C. Morris. Feb. 24, 1932. 396,835.

PROCESS FOR OBTAINING FAST TINTS ON WOOL.—A. G. Bloxam. (Soc. of Chemical Industry in Basle). March 31, 1932. 396,859.

MANUFACTURE AND PRODUCTION OF CARBAMIC ACID CHLORIDE.—J. Y. Johnson (I. G. Farbenindustrie). April 15, 1932. 396,870.

PROCESS FOR DYEING OR PRINTING TEXTILE MATERIALS CONSISTING OF OR CONTAINING CELLULOSE ESTERS AND CELLULOSE ETHERS.—Soc. of Chemical Industry in Basle. May 23, 1931. 396,892.

MANUFACTURE OF ORTHO-OXYAZO DYESTUFFS.—W. W. Groves (I. G. Farbenindustrie). May 23, 1932. 396,895.

MANUFACTURE OF VARNISHES, LACQUERS, OR PUTTY MASSES.—Deutsche Hydrierwerke Akt.-Ges. July 4, 1931. 396,924.

MANUFACTURE OF OPTICALLY ACTIVE 1-MONOHYDROXY-PHENYL-2-AMINOPROPANOLS (1).—I. G. Farbenindustrie. Sept. 19, 1931. 396,951.

MANUFACTURE OF CEMENT POWDERS.—I. G. Farbenindustrie. Oct. 29, 1931. 396,964.

PRODUCTION OF PROPIONIC ACID BY FERMENTATION.—Commercial Solvents Corporation. June 29, 1932. 396,968.

PROCESS FOR REMOVING ACID CONSTITUENTS FROM GASES, AND RENDERING SAID CONSTITUENTS UTILISABLE.—Metallges Akt.-Ges. Nov. 10, 1931. 396,969.

MANUFACTURE OF NITROGENEOUS DERIVATIVES OF THE ANTHRAQUINONE SERIES.—Soc. of Chemical Industry in Basle. Dec. 22, 1931. 396,976.

DYEING OF PRINTING PAPER OR PAPER PULP.—Soc. of Chemical Industry in Basle. Dec. 18, 1931. 396,992.

MANUFACTURE OF WATER-INSOLUBLE AZO-DYESTUFFS ON THE FIBRE.—I. G. Farbenindustrie. Jan. 18, 1932. 397,016.

PROCESS FOR THE MANUFACTURE OF 3.4.5-TRISUBSTITUTED-TRIAZOLES (1.2.4.)—Schering-Kahlbaum Akt.-Ges. Feb. 13, 1932, 396,778.

PROCESSES OF MAKING REACTION PRODUCTS OF KETONE.—Carbide and Carbon Chemicals Corporation. Feb. 16, 1932. 397,025.

MANUFACTURE OF 2-(3¹-HYDROXYNAPHTHYL-2¹)-4-HYDROXY-6:7-BENZO-PSEUDO-AZIMINOBENZENES AND AZO DYESTUFFS THEREFROM.—I. G. Farbenindustrie. Feb. 9, 1932. 396,741.

MANUFACTURE OF TETRAZO COMPOUNDS.—I. G. Farbenindustrie. Feb. 24, 1932. 397,034.

PROCESS OF IMPROVING THE TASTE OF HYDROGENATED FATTY OILS. D. Hildisch. Feb. 27, 1933. 397,039.

MANUFACTURE OF ETHYL ALCOHOL.—Distillers Co., Ltd., W. P. Joshua, H. M. Stanley and J. B. Dymock. Jan. 29, 1932. 396,724.

Applications for Patents

AZO DYESTUFFS.—E. I. Du Pont De Nemours & Co. Aug. 4. (United States, Aug. 4, '32.) 21959.

REGULATOR FOR CARBON-DIOXIDE.—F. Ehring. Aug. 4. 21971.

MANUFACTURE OF BASES FROM BENZ-DIOXANE.—H. D. Elkington (Soc. des Usines Chimiques Rhône-Poulenc.) Aug. 5. 22102.

CARBONISATION OF COAL AT LOW TEMPERATURES.—H. A. S. Gothard, W. Johnson, and T. H. Parry. July 31. (Jan. 29, '32.) 21517.

MANUFACTURE OF ACID AMIDE DERIVATIVES.—I. G. Farbenindustrie. Aug. 2. (Feb. 28.) (Germany, Feb. 29, '32.) 21744.

MANUFACTURE OF SODIUM CARBONATE DECAHYDRATE.—Imperial Chemical Industries, Ltd. July 31. 21526.

RUBBER-COMPOUNDING INGREDIENTS.—Imperial Chemical Industries, Ltd. July 31. 21527.

MANUFACTURE OF PRINTING-INKS.—Imperial Chemical Industries, Ltd. Aug. 3. 21844.

LIQUID OXYGEN EXPLOSIVES.—L. Mellersh-Jackson (Soc. l'Air Liquide Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude.) Aug. 3. 21859.

PREPARING FLUORINE DERIVATIVES OF HYDROCARBONS.—Kinetic Chemicals, Inc. Aug. 5. (United States, Aug. 10, '32.) 22089 and 22090.

PRODUCTION OF CALCIUM FORMATE.—R. Koepp & Co. Aug. 4. (Germany, Aug. 13, '32.) 21993.

DISTILLATION OF ZINC, ETC.—F. Krupp Grusonwerk. Aug. 3. (Germany, Sept. 23, '32.) 21854.

MANUFACTURE OF ALKALI CYANIDES.—Naamlooze Vennootschap Stikstofbindingsindustrie Nederland. Aug. 3. (Germany Aug. 4, '32.) 21819.

TREATMENT OF FISH FOR MANUFACTURE OF OILS, ETC.—A. Oysthus. Aug. 5. 22103.

MANUFACTURE OF CYCLIC α-CYANKETIMIDES, ETC.—Schering-Kahlbaum A.-G. Aug. 4. (Germany, Aug. 15, '32.) 21991.

PROCESS FOR OBTAINING ALUMINA.—J. C. Seailles. July 31. (Belgium, July 30, '32.) 21547.

PRODUCTION OF CELLULOSE DERIVATIVES FROM FIBROUS SUBSTANCES.—Uddeholms Aktiebolag Skoghalls-Verken. July 31. (Germany, Nov. 29, '32.) 21515.

CONTINUOUS DISTILLATION OF HYDROCARBONS, ETC. A. Wagner. July 31. (Germany, Aug. 1, '32.) 21530.

PRODUCTION OF ALCOHOLS.—H. T. Böhme Akt.-Ges. Aug. 9. (Germany, Sept. 3, '32.) 22313.

VAT DYES.—E. Burgoine, and Imperial Chemical Industries, Ltd. Aug. 8. 22141.

MOLYBDENUM STEELS.—Cleveland Twist Drill Co. Aug. 10. (United States, Aug. 20, '32.) 22372.

MANUFACTURE OF OXYGENATED ORGANIC COMPOUNDS.—H. Dreyfus. Aug. 9. 22262.

MANUFACTURE OF INTERMEDIATES FOR THIOINDIGO DYESTUFFS.—E. I. Du Pont De Nemours & Co. Aug. 10 (United States, Aug. 10, '32.) 22371.

VERMIN DESTROYERS.—H. A. Gill (A.-G. für Medizinische Produkte.) Aug. 12. 22587.

Complete Specifications Open to Public Inspection

MANUFACTURE OF DYESTUFFS OF THE ANTHRAQUINONE SERIES.—I. G. Farbenindustrie. Feb. 8, 1932. 3755/33.

PROCESS FOR THE MANUFACTURE OF CONDENSATION PRODUCTS.—I. G. Farbenindustrie. Feb. 8, 1932. 3756/33.

PROCESS FOR THE MANUFACTURE OF AZO DYESTUFFS AND INTERMEDIATE PRODUCTS THEREFROM.—I. G. Farbenindustrie. Feb. 8, 1932. 3904/33.

PROCESS FOR THE MANUFACTURE OF PLASTIC MATERIALS.—I. G. Farbenindustrie. Feb. 9, 1932. 4024/33.

SOLID VVAT DYESTUFF PREPARATIONS.—I. G. Farbenindustrie. Feb. 10, 1932. 4025/33.

PROCESS FOR THE MANUFACTURE OF STABLE DIAZONIUM COMPOUNDS. I. G. Farbenindustrie. Feb. 13, 1932. 4419/33.

PRODUCTION OF OILS OF LOW-BOILING POINT, ETC.—E. Hindmarch, A. M. O'Brien, and Scottish Gas Utilities Corporation. Ltd. Aug. 11. 22518.

PRODUCTION OF ETHYL ALCOHOL FROM ETHYLENE.—G. F. Horsley, and Imperial Chemical Industries, Ltd. Aug. 11. 22517.

From Week to Week

E. I. DU PONT DE NEMOURS AND CO., Everett, and the New England Mica Co., Waltham, both in Massachusetts, U.S.A., were two of 34 manufacturers reporting no lost-time accidents during the first six months of 1933.

THE MARRIAGE TOOK PLACE on August 16, at Princes Road Synagogue, Liverpool, of Simon Bernard Casson, B.Sc. (Tech.), F.I.C., M.I.Chem.E., of Manchester, to Miss Rae Shannon, of Wallasey.

THE DEATH OF MR. T. A. O'DONAHUE (59), a mining engineer, is reported from Birmingham. He was educated at Wigan Mining and Technical College, and was at one time editor of "Mining Engineering." Since 1910 he had been mineral specialist to the Inland Revenue valution office.

THE DEATH TOOK PLACE at the White House, Killiney, County Dublin, last week, of Mr. William H. Boyd, who, until recently, was managing director of Boileau and Boyd, Ltd., manufacturing chemists, of 91 Bride Street and 46 Mary Street, Dublin.

THE REASON WHY SO MANY SHEEP died after dipping operations in Carnarvonshire is held to be that the hot weather experienced caused the pores of the skin to open sufficiently to admit the dip into the body, thus causing poisoning. This could easily be avoided if special dips used in hot countries were supplied to British farmers for use in such cases as that reported.

THE ANNUAL MEETING of the British Association for the Advancement of Science will be held at Leicester this year from September 6 to 13. The presidential address will be given by Sir Frederick Gowland Hopkins, president of the Royal Society, who will take as his subject, "Some Chemical Aspects of Life." Sectional presidents' addresses will be given during the week.

A DIPLOMA OF HONOUR has been awarded by the Royal Cornwall Polytechnic Society to Bickford, Smith and Co., Ltd., Camborne, for improvements in the manufacture of safety fuses, and a diploma of merit to Colonel J. E. T. Barbary, Gwennap, for improvements in the manufacture of gutta-percha for safety fuses. Both awards are in connection with exhibits at the society's centenary meeting held recently.

THE ANNUAL DINNER AND DANCE of the Institute of Fuel will be held at the Connaught Rooms, Great Queen Street, London, W.C.2, on Wednesday, October 18, when the President-elect, Sir William J. Larke, will receive members and guests at 6.45 p.m. for 7.15 p.m. During the dinner the Melchett Medal will be presented to Sir John Cadman, by the President. The price of tickets for the dinner and dance, exclusive of wines, is 21s. each.

AFTER RUNNING SUCCESSFULLY to catch a bus, Mr. William Pickup (73), of Blackburn, collapsed suddenly and died. He was a mining engineer and had for 34 years been a director of the Rishton Colliery. Among his other activities was the vice-presidency, for four years, of the Institute of Mining Engineers. He was also a member of the London Geological Society, the Cheshire Safety in Mines Research Committee, and the Manchester University Advisory Board for mining education.

AN ADVISORY COMMITTEE set up to select Fellows for the Leverhulme Research Fellowships, to which the trustees of the will of the first Lord Leverhulme decided to set aside £12,000 a year, have made the following appointments: D. H. Hammick—"Investigations on the interaction of nitro-compounds with aromatic bases and hydrocarbons," and W. F. K. Wynne-Jones—"The nature of acids and bases." Application forms for further Fellowships may be obtained from the Secretary, Union House, St. Martin's-le-Grand, E.C.1.

THE SIR JOHN CASS TECHNICAL INSTITUTE, Jewry Street, Aldgate, E.C.3, will commence their new session, extending over about 36 weeks, on September 25, and students will be enrolled during the preceding week. The science courses are arranged to meet the requirements of those engaged in chemical, metallurgical, electrical, petroleum and fermentation industries, and are held from 6 to 10 p.m. Full facilities are provided in well-equipped laboratories for special investigations and research, and the instruction in experimental science provides systematic courses for the examinations of London University, the Institute of Chemistry, and the Institute of Brewing.

THE WOLVERHAMPTON METAL CO., Wednesfield, was the scene of a serious fire on Monday night. The outbreak started in the aluminium department, and was accompanied by a series of explosions. On the arrival of the fire brigade it was found that bags of aluminium were ablaze. Just as the firemen thought they had controlled the fire, a terrific explosion blew off the roof of the building, and upset the playing of hoses for some minutes. The sparks from this explosion caused many more bags of foil to catch fire. It is thought that as the aluminium melted it poured out of the bags and came into contact with water from the hoses. Four workmen were injured and the firemen at the hoses had to work in relays owing to the fumes.

VICTOR HERBERT VELEY, M.A., D.Sc., F.R.S., died on August 21 at 8 Marlborough Place, St. John's Wood, N.W., aged 78. The cremation took place at Golders Green on Wednesday.

THE MELCHETT LECTURE of the Institute of Fuel will be delivered by Sir John Cadman, in the lecture theatre of the Geological Society, Burlington House, London, on Wednesday, October 11, at 5.30 p.m.

THE NOR-RUST LIQUID LEAD CO., LTD., have secured a contract from the Exmouth Gas Co. to remove all existing paint and clean, by their sandblasting method, the whole of the surfaces of the one million cubic feet gas-holder, and to re-coat it with their metallic lead alloy "Nust."

THE FUNERAL OF GEORGE SALES JARMAIN, of Dalton Lodge, Huddersfield, took place on August 17 at Almondbury. Mr. Jarmain was president of the Wool Carbonisers' Federation, and head of Jarmain and Son, Ltd., carbonisers, scourers and bleachers of Kirkheaton.

THE ORGANISATION OF THE COTTON INDUSTRY in Lancashire is developing rapidly. The State of Trade Committee has held three meetings and a few employers have met privately. It is suggested that mills outside the combines should be grouped according to yards spun. The great need is for quick, united action to counteract ruinous competition.

THE FOURTEENTH EXPOSITION of Chemical Industries will be held at Grand Central Palace, New York, from December 4 to 9. The dean of the School of Chemistry of Rutgers University will direct the programme of student courses, and assistance in the management of the exhibition will also be rendered by a group of chemists and chemical engineers.

THE APPEARANCE IN THE BORAX-BEARING DISTRICT of Larderello, in the Val di Cecina, Italy, of a new geyser (*soffione*) has suggested the idea that this geyser, together with those which gushed up in 1931 and 1932, should be utilised for electrical energy for the railways. The new geyser, which has a diameter of 10 in., is said to emit steam with a pressure of four atmospheres and a temperature of 190° C.

THE ELEVENTH ANNUAL REPORT of the Safety in Mines Research Board, obtainable at H.M. Stationery Office (price 2s.), contains a study of the practical value of protective equipment, such as hard hats, goggles and special boots. The report states that the metallurgical examination of broken haulage gear at Sheffield University has been further developed under Professor J. H. Andrew. Statistics of accidents are also given.

A FIRE OCCURRED AT LEYTONSTONE last week in a yard between two factories belonging to the London Battery and Cable Co., Ltd., accumulator manufacturers. Oxygen cylinders exploded and added to the confusion, as red-hot metal fell among crowds in neighbouring streets. Hundreds of accumulators were destroyed and factory windows were shattered by the explosions, while dense clouds of smoke caused many to believe that the outbreak was more serious than it turned out to be.

AMONG THE MANY DEATHS DUE TO BATHING are reported those of Lt.-Col. Oliver Cecil Clare, of Abbey Chase, Chertsey, and Frederick Mears, of Eltham Park, S.E. Lt.-Col. Clare, chairman of the Triplex Safety Glass Co., and a director of Paripan, Ltd., had a seizure on leaving the water at Selsey, where he was staying with his family. He served in the South African War and the Great War, and was well known as a racehorse breeder. He was 52. Mr. Mears, who was drowned at Southbourne on Monday, in full view of his wife and children, was an employee of the Anglo-American Oil Co.

THE DEATH IS REPORTED FROM AMERICA of George Melville Lynn, divisional research chemist of the Columbia chemical division of the Pittsburgh Plate Glass Co., Barberton, Ohio, as the result of a motor accident. Dr. Lynn was 37 years old, but had occupied his position since 1928, having previously been engaged in graduate work at Yale University and as a lecturer at Pittsburgh University. The Pittsburgh Plate Glass Co. is the largest concern of its kind in the United States, and it is noteworthy that Dr. Lynn was largely responsible for improvements in the ammonia soda process and in the development of by-products.

WE REGRET TO ANNOUNCE THE DEATH on Monday, as the result of an operation, of Sir Kenyon Pascoe Vaughan-Morgan, vice-chairman of the Morgan Crucible Co., Ltd., Battersea, and a director of L. and N. Coal Distillation, Ltd. Sir Kenyon, who received a knighthood in 1929, had sat as Conservative M.P. for Fulham East since 1922. Among his many public offices was that of a governor of St. Bartholomew's Hospital, and he was prominent as an advocate of improvements to the main traffic routes out of London. The Morgan Crucible Co. was founded in 1856 by Morgan Brothers, and the Morgan family has retained an interest ever since. Sir Kenyon was 59 years of age, and leaves two sons and a daughter.

POISONING BY CARBON MONOXIDE and sulphuretted hydrogen are not to be scheduled as industrial diseases. This has been decided by the Workmen's Compensation (Industrial Diseases) Committee, who issued a report last Monday. Representatives of employers and trade unions were called upon for their views before the committee came to a unanimous decision on the matter.

NOTICE IS GIVEN in the "London Gazette" that creditors of British Tintex and Dye Products, Ltd. (in voluntary liquidation) are required, on or before September 9, 1933, to send their names and addresses, with particulars of their debts or claims, and the names and addresses of their solicitors (if any) to the liquidator, John Frederick Mallabar, 1 Regent Street, London, S.W.1.

A PLANT FOR THE COMMERCIAL RECOVERY of bromine from seawater is to be constructed at Kure Beach, about twenty miles south of Wilmington, United States, by the Ethyl-Dow Chemical Co., a new company formed jointly by the Ethyl Gasoline Corporation, of New York, and the Dow Chemical Co., of Midland, Michigan. The output will be utilised entirely by the Ethyl Gasoline Corporation as a constituent of ethyl fluid.

AMONG THE LATEST WILLS proved are the following:—John Bates, director and London manager of C. F. Stead and Co., Ltd., Sheepscar Leather Works, Leeds, and vice-president of the Federation of Light Leather Tanners and Dressers for 1932, £14,036 (net personalty £12,307); Joseph Francis Pickering, chairman of Joseph Pickering and Sons, Ltd., Sheffield, polishing paste manufacturers, £23,261 (net personalty £22,704); Edward Hanger, Norbury, Surrey, paint manufacturer, £17,531 (net personalty £16,533); Henry Lloyd Snape, of Torquay, at one time professor of chemistry at University College, Aberystwyth, £5,469 (net personalty £5,398); Bernard Charles Holden, Stratford-on-Avon, a director of Arthur Holden and Sons, paint and varnish manufacturers, Birmingham, £12,592 (net personalty £10,301); William Gibbins, of Hewletts, near Cheltenham, former chairman of the Birmingham Battery and Metal Co., Ltd., £235,510 (net personalty £223,791).

THE IMPORT DUTIES ADVISORY COMMITTEE announce that they have decided not to make any recommendations in respect of the applications previously advertised for (a) an increase in the import duty on tools and machinery parts wholly or partly manufactured of natural or artificial abrasives; (b) the adjustment of the duties on brown artificially fused aluminium oxide and natural emery garnet and corundum in grain; and (c) the addition to the free list of white artificially fused aluminium oxide, whether in the lump or in grain; brown artificially fused aluminium oxide; and natural garnet and corundum in the lump only.

WM. GARDNER AND SONS (GLOUCESTER), LTD., iron and metal founders, will be showing at the forthcoming Bakers' and Confectioners' Exhibition (September 2-8), and the Grocers' and Allied Trades Exhibition (September 16-22), both of which will be held at the Royal Agricultural Hall, Islington, N.1. Their exhibits will include the latest sifting and mixing plant, various types of grinding and pulverising machinery, and feeding and elevating apparatus. They will also show their latest vertical mixer direct coupled to motor, and a patent sprayer for adding liquids, oils, etc. The firm's directors and representatives will be in attendance.

A PROSPECTUS OF A DEBENTURE ISSUE, created for conversion purposes, by the Niger Co., was published in "The Times" on August 23. The amount of £2,747,648 in 4 per cent. consolidated guaranteed debenture stock which is offered for sale by Lazard Brothers and Co. at 102 per cent. The issue is made in connection with the redemption of the outstanding £3,663,530 5½ per cent. guaranteed debenture stock, notice of the repayment of which at 106 on December 15 has been given to stockholders. The Niger Co. is now entirely a holding company, its principal investment being 65 per cent. of the share capital (another 15 per cent. being held by Unilever and its subsidiaries) of the United Africa Co., which was formed in 1929 to take over the trading business both of the Niger Co. and of the African and Eastern Trading Corporation, and later the West African interests of Unilever.

Company News

John Oakey and Sons, Ltd.—An interim dividend of 2½ per cent., less tax, is announced, payable on September 1. Last year a similar initial distribution was followed by a final payment of 8½ per cent., against 7½ per cent. in the two preceding years.

Eastman Kodak Co. of New Jersey.—The company has notified British shareholders of the concern that as from October 1 their dividends will be subject to an excise tax of 5 per cent., deducted at the source, in accordance with Section 213 (a) of the Industrial Recovery Act, which became law on June 16, 1933.

Broken Hill Proprietary Co., Ltd.—For the year to May 31 last a net profit is reported of £313,617, after providing £300,483 for depreciation and £34,128 debenture interest, which compares with £103,720 in 1931-32. The directors have deemed advisable the transfer of £200,000 from appropriation account for depreciation, for writing off plant not usable in reconstruction.

Johns-Manville, Ltd.—A net loss is reported for the six months ended June 30 last of $861,595, against a net loss of $1,514,877 in the first half of 1932. The net profit for the June quarter was $92,204, after allowing for taxes and charges, equal to $1.23 a share on 75,000 shares of 7 per cent. preferred stock, against a net loss of $953,799 in the preceding quarter and a net loss of $602,270 in the June quarter of 1932.

International Nickel Co. of Canada, Ltd.—For the three months ended June 30 last the company reports a net profit of $1,943,047, which is equivalent to 10 cents per share on the common stock, after allowing for preferred dividend. The first quarter of 1933 showed a net loss of $80,158. For the first six months of this year the net profit, after the usual deductions, was $1,862,889, which is equivalent to 6 cents per share on the common stock, and compares with a net loss of $93,255 for the first six months of 1932.

Calico Printers' Association.—After provision for maintenance, depreciation, etc., the profits for the year to June 30, 1933, amount to £123,926, compared with £157,458 a year ago. With £10,475 brought forward, the available total is £134,401, against £161,281. Preference dividend for the half-year to December last absorbed £75,402, and the directors have resolved to transfer £50,000 from general reserve, and recommend the payment of the half-yearly Preference dividend to June 30. The carry-forward is thus increased to £33,596. The directors are unable to recommend a payment on the ordinary stock, on which no distribution has been made since 1929. In the preceding period—when the profit of £157,458, compared with a loss of £175,289 for 1930-31—the interim dividend on the preference stock was deferred; full payment was, however, made when the year's results were known.

New Companies Registered

British White Lead Co., Ltd. Registered August 3. Nominal capital £100 in £1 shares. Manufacturers of and dealers in white lead, etc. Directors: F. G. Martin, The Hollies, Woodford Green; P. Anderson and P. Blenkinsop.

M. E. Dougherty, Ltd.—Registered August 16. Nominal capital £1,200 in £1 shares (1,100 6 per cent. cumulative preference and 100 ordinary). Importers and exporters of and dealers in synthetic resin, coal tar and petroleum products, chemical merchants, etc. Subscribers: M. M. Williams, 4 Lloyds Avenue, E.C.3; and W. C. Waugh. Solicitors: Coburn and Co., 6 Drapers Gardens, E.C.2.

Medway Fine Chemicals (1933), Ltd. Registered August 10. Capital £33,000 in 60,000 "A" ordinary and 5,000 "B" ordinary shares of 10s. each, 6,667 "A" deferred and 3,333 "B" deferred shares of 1s. each. Manufacturers, importers and exporters of and dealers in chemicals, fine chemicals, and chemical intermediates, salts, acids, gases, disinfectants and chemical compositions, etc. Directors: P. V. F. Cazalet, Shipbourne Grange, Tonbridge, Kent; Major B. Handford, and K. J. A. Beugger.

Metalfix, Ltd., 2 Clements Inn, Strand, W.C.2. Registered August 18. Nominal capital £500 in £1 shares. Manufacturers of and dealers in glue, gum, adhesive paste and similar substances, oils and oleaginous and saponaceous substances, etc. Directors: H. Stange, Oslo, Karl Johansgate 2; N. Blomberg, and H. G. Walterstorff.

Organic Extractives, Ltd.—Registered August 17. Nominal capital £5,000 in 500 7 per cent. cumulative preference shares of £1 and 22,500 ordinary shares of 4s. each. To acquire from Dr. J. R. Schindelmeiser, G. F. Summers, T. F. Thompson and C. S. Townsend, the right to manufacture under the personal supervision of the said Dr. Schindelmeiser, the secret novel and patentable processes for the production of carotene, diacetyl and glutamic acid, to equip a factory to manufacture and an organisation to sell such products in Great Britain and Northern Ireland, and to carry on the business of manufacturing chemists, etc. Directors: T. F. Thompson, Denemead, Deepdene Gardens, Dorking; G. F. Summers; Dr. J. Schindelmeiser and Chas. S. Townsend.

A. D. Radburn & Co., Ltd. Registered August 14. Capital £500 in £1 shares. Manufacturers, importers and exporters of and wholesale and retail dealers in chemical and pharmaceutical preparations, cereals and their products. Directors: Herbert E. Whiting, and George Royer. Solicitors: Thorp, Saunders & Thorp, 79 Salisbury House, E.C.2.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Australia.—A Sydney firm of agents, a member of which is at present in the United Kingdom, desire to secure the representation for Australia of United Kingdom manufacturers of dyes and chemicals for the textile trade. (Ref. No. 169.)

France.—An agent established at Paris wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of tin solder for use in plumbing, boiler-making, preserving, etc. (Ref. No. 185.)

Iraq and Palestine (Bagdad and Tel-Aviv).—A commission agent desires to represent United Kingdom manufacturers of paints, enamel varnishes, and linseed oil in Iraq and Palestine. (Ref. No. 196.)

South Africa.—A Bloemfontein firm of wholesale chemists desire to act as sole distributors in the Orange Free State for United Kingdom manufacturers of surgical and chemical glassware, surgical rubber goods, tooth brushes and pharmaceutical specialities. (Ref. No. 174.)

South Africa.—The Imperial Trade Correspondent at Port Elizabeth reports that the Municipality of Port Elizabeth is calling for tenders, to be presented in Port Elizabeth by September 28, for the supply, delivery and erection of a chlorination plant. (Ref. G.Y. 12887.)

Forthcoming Events

Aug. 26.—North of England Institute of Mining and Mechanical Engineers. 2.30 p.m. Newcastle-on-Tyne.

Sept. 28.—Institute of Fuel. Visit to Battersea and Barking new Power Stations.

Books Received

Sicherheitsglas. By Dr. H. G. Bodenbender. Berlin: Dr. Bodenbender. Pp. 320. RM. 18.

Reports on the Progress of Naphthology, 1932. Reprinted from the Journal of the Institution of Petroleum Technologists. Pp. 677. 10s. 6d.

Inorganic Colloid Chemistry. By Harry Boyer Weiser. London: Chapman & Hall, Ltd. Pp. 390. 28s.

Organic Syntheses. London: Chapman & Hall, Ltd. Pp. 120. 10s. 6d.

City of Salford. Annual Report of the City Analyst for the year 1932. By H. E. Monk. Pp. 44.

Official Publications

Economic Conditions in the Netherlands, 1932. Report by R. V. Laming. Department of Overseas Trade. London: H.M. Stationery Office. Pp. 130. 3s. 6d.

Economic Conditions in the Netherland East Indies. Report by H. A. N. Bluett. Department of Overseas Trade. London: H.M. Stationery Office. Pp. 164. 4s. 6d.

Economic Conditions in the Argentine Republic. Report by Stanley G. Irving. Department of Overseas Trade. London: H.M. Stationery Office. Pp. 193. 5s.

Report of the Chief Inspector of Factories and Workshops, 1932. London: H.M. Stationery Office. Pp. 134. 2s., postage extra.

Economic Conditions in Newfoundland, to April, 1933. By H. F. Gurney. Department of Overseas Trade. London: H.M. Stationery Office. Pp. 64. 2s.

Report of the Food Investigation Board, 1932. Department of Scientific and Industrial Research. London: H.M. Stationery Office. Pp. 304. 5s.

ADVERTISERS please note that the latest hour at which we can accept advertisements for insertion in these columns each week is 10 o'clock on Thursday morning.

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APPOINTMENTS WANTED

(Prepaid—Twenty-seven words 1s. 6d.; every additional nine words 6d.) Replies can be received "Box , Office of this Journal," in which case our address is included in cost of advertisement, and charged as nine words.

GRADUATE, First Class Honours Chemistry, 1933. Age 20, seeks post, preferably research. Excellent references. F. Viol, 7 Frinton Road, East Ham, E.6.

HONS. GRADUATE A.R.C.S., B.Sc. (Lond.), A.I.C., wants work. Hons. Chemistry, Botany, Physics, Micro-Biology. Age 21. 3 years analytical experience. Extremely capable. Box No. 1509, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

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ADVICE on Protection of Inventions and Registration of Trade Marks. Send for free booklets. REGINALD W. BARKER AND CO., Patent Agents, 56 Ludgate Hill, E.C.4. (Estab. 46 years.) Telephone: Central, 1882.

PATENTS obtained, trade marks and designs registered, at home and abroad.—GEE AND CO. (Patent and Trade Mark advisers to THE CHEMICAL AGE), 51-52 Chancery Lane, London, W.C.2. Telephone: Holborn 1525. Established 1905.